



Armed Forces College of Medicine AFCM



Histological Structure of the Liver

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Prof. of Histology

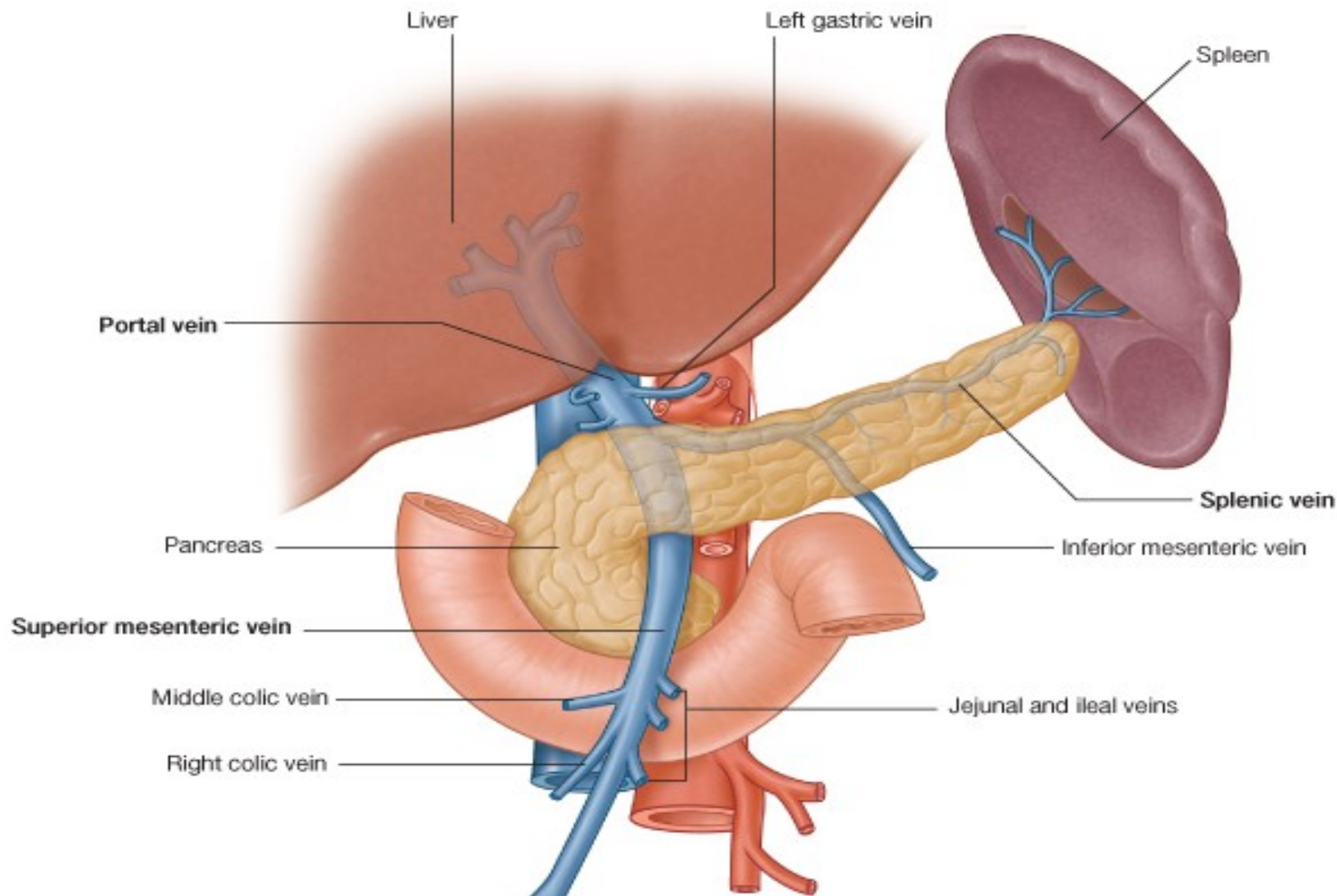
The Liver



ILOs:

- Describe the basis of the different classifications of hepatic lobules.
- Describe the structure of components of the classic hepatic lobule.
- Correlate the structure of hepatic lobules to their functions
- Describe the light and electron microscopic picture of hepatocytes.
- Interpret the altered microscopic structure of the hepatic lobules & hepatocytes in different diseases.

The Liver



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The Liver



The liver

Compound
tubular
gland

The largest
gland of the
body

**Endocrine
function**



**Plasma
proteins**

**Exocrine
function**



**Bile
secretion**

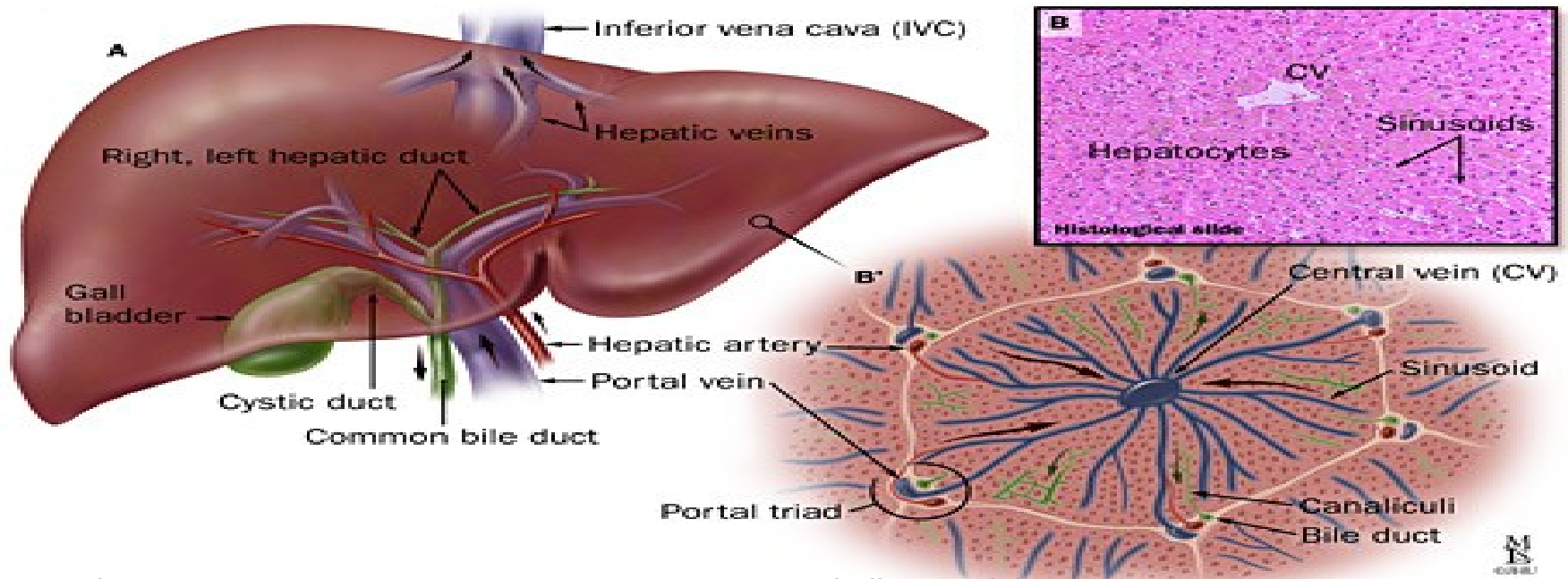
The Liver

Structure of the Liver

STROMA

1. Capsule
2. Trabeculae
3. RCT

PARENCHYMA



Structure of the Liver

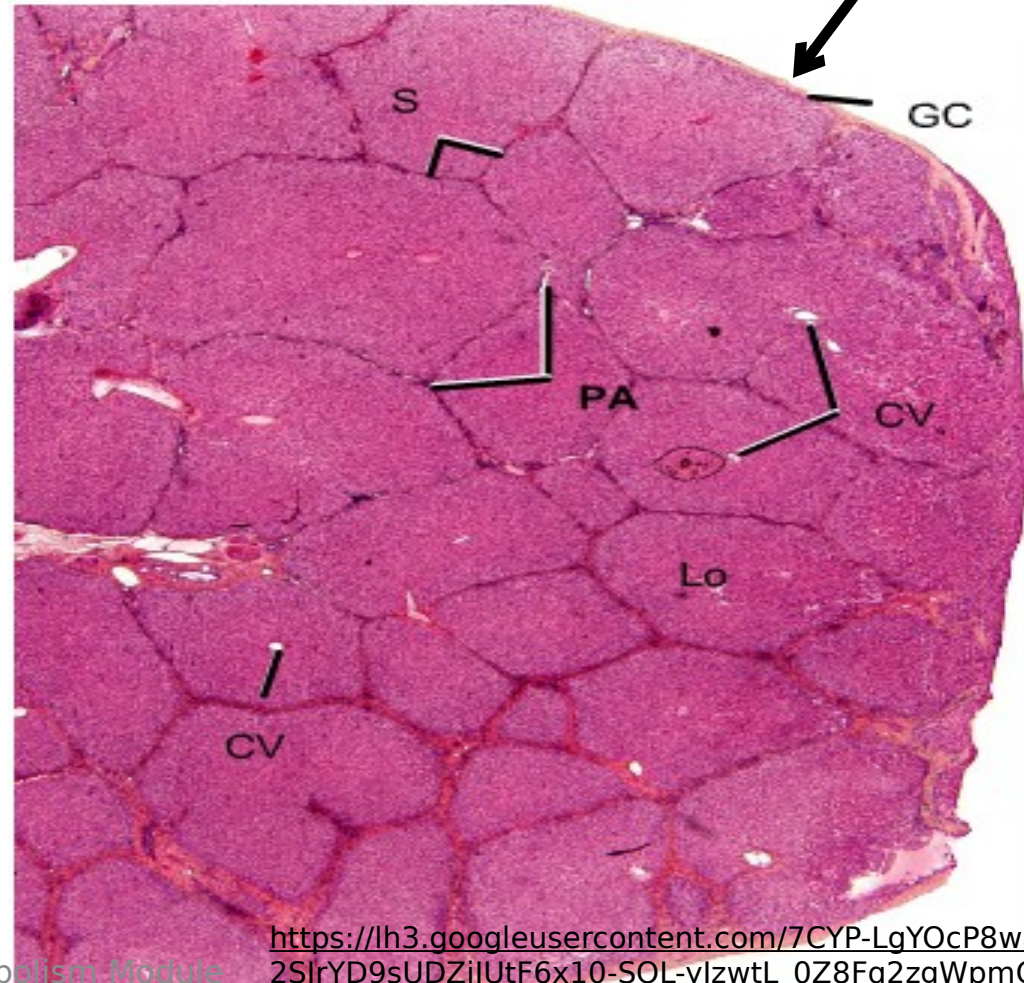


STROMA

PARENCHYMA

1-CAPSULE

Connective tissue capsule (**capsule of Glisson**): Dense CT covered by peritoneum & is thick at the porta hepatis to send septa.



Structure of the Liver

STROMA

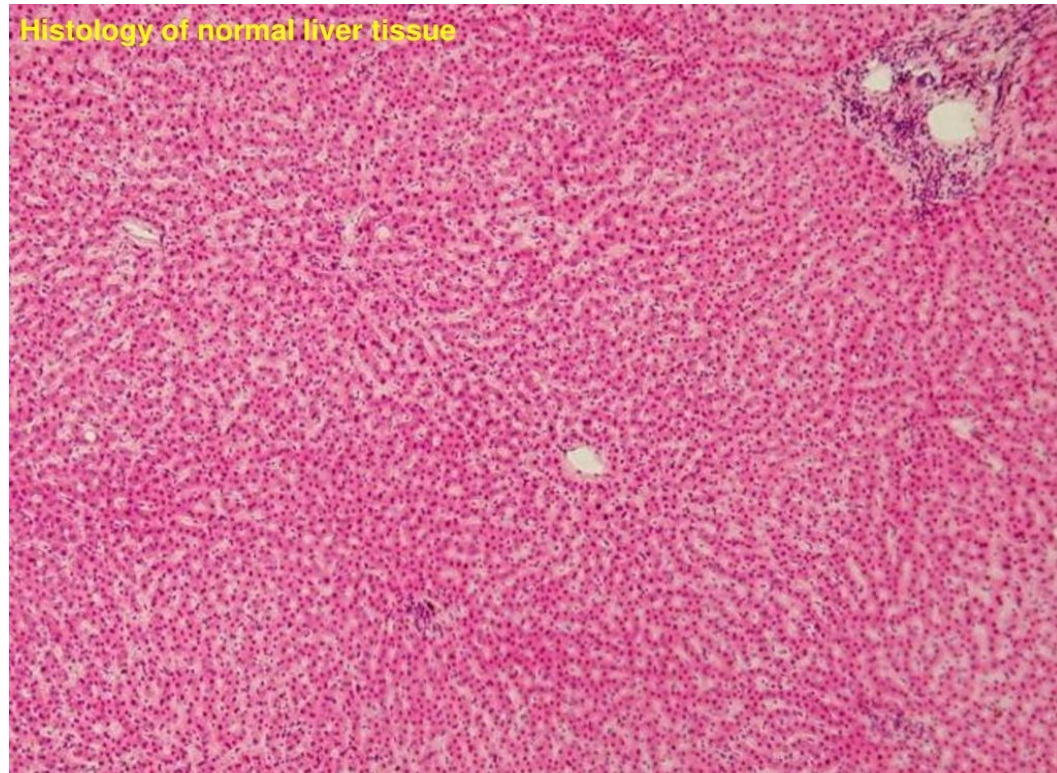
PARENCHYMA

2-TRABECULAE



Interlobular septa:
Thin in human but
thick in animals

Histology of normal liver tissue



Structure of the Liver

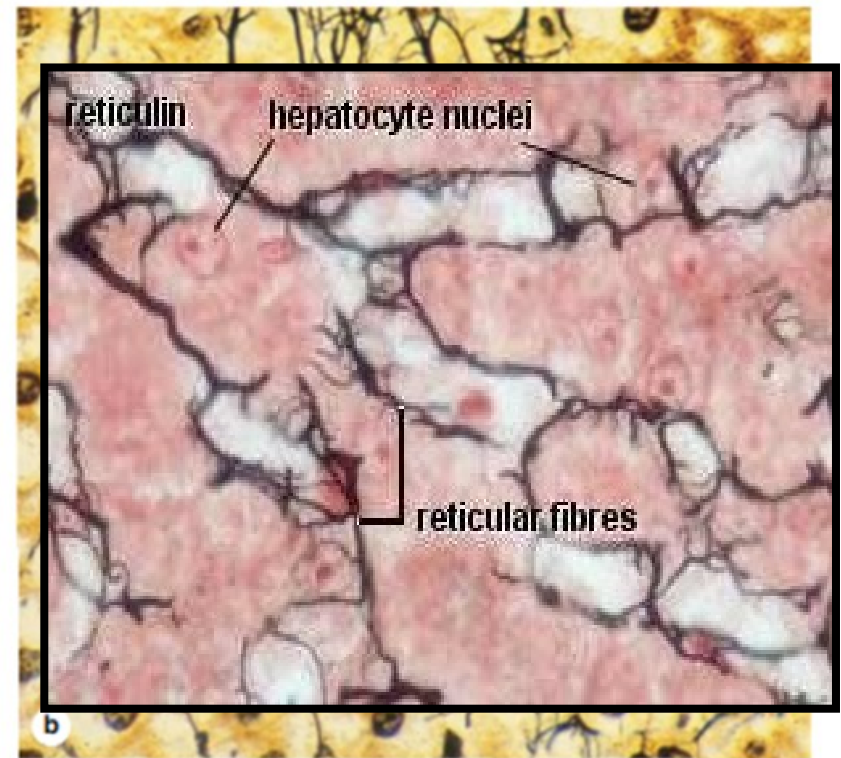
STROMA

3-Reticular connective tissue



Short branching & anastomosing fibers, forming network that holds the cells in their place

PARENCHYMA



STRUCTURE OF the liver

STROMA

PARENCHYMA

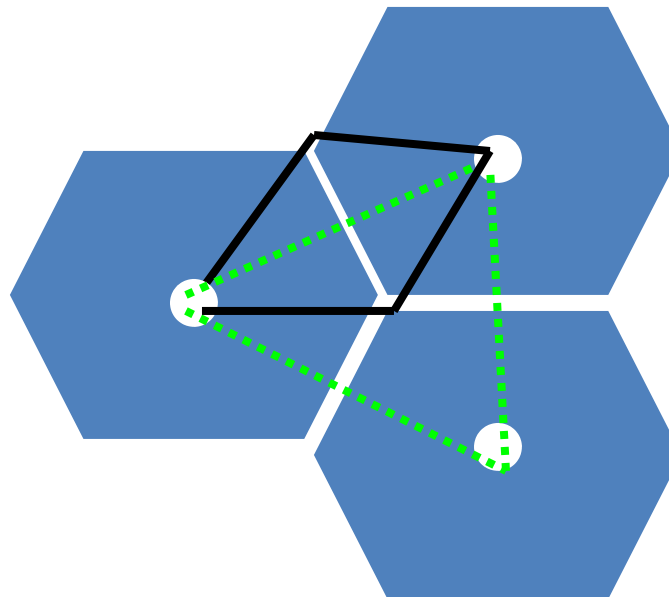
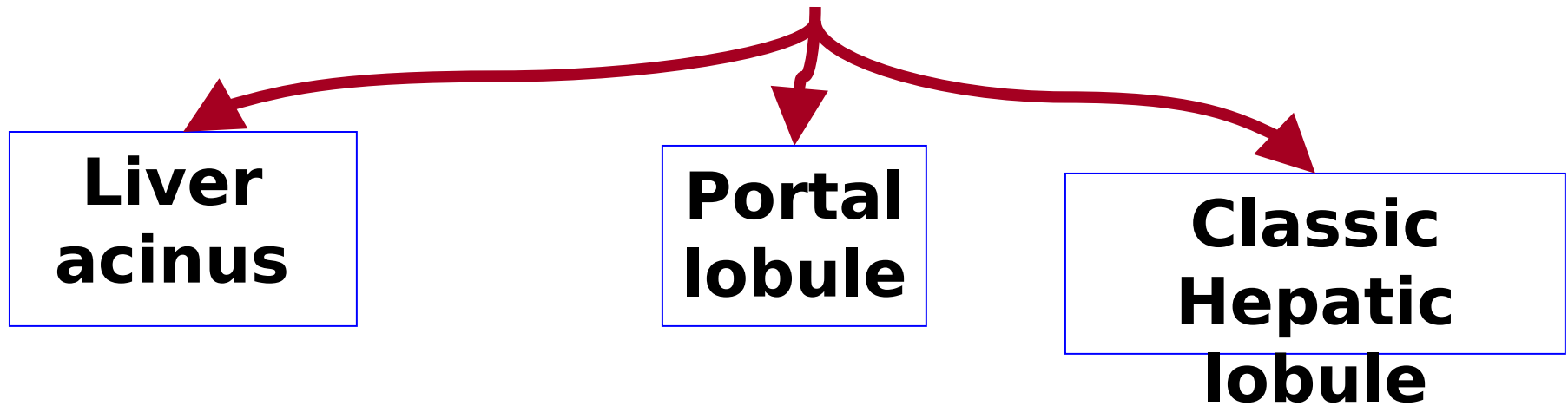
Hepatocyte



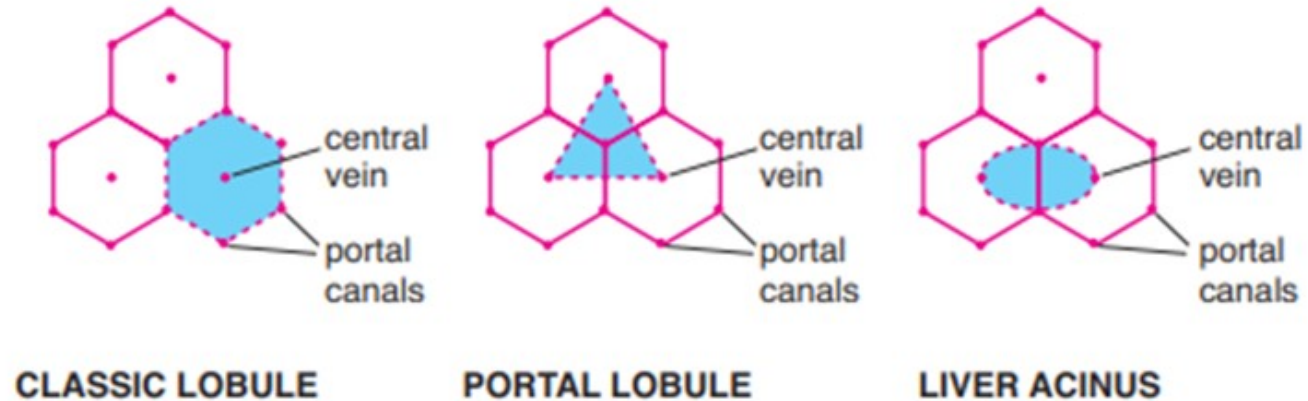
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Liver Cell
(Hepatocyte)

Classification of Hepatocyte organization



Liver Lobules

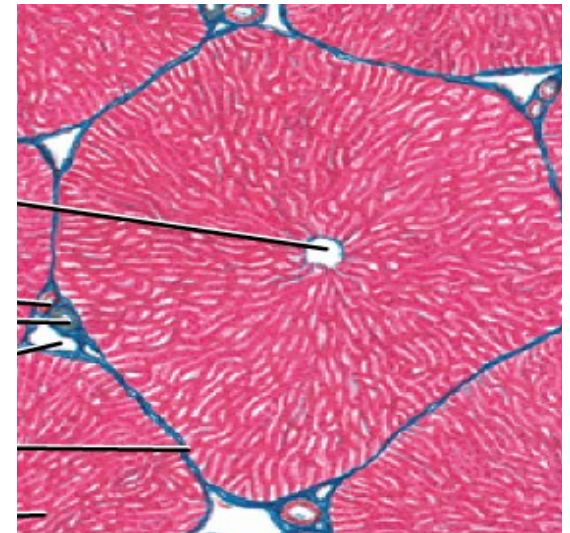
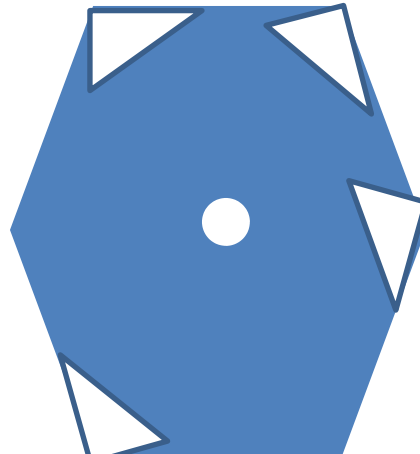
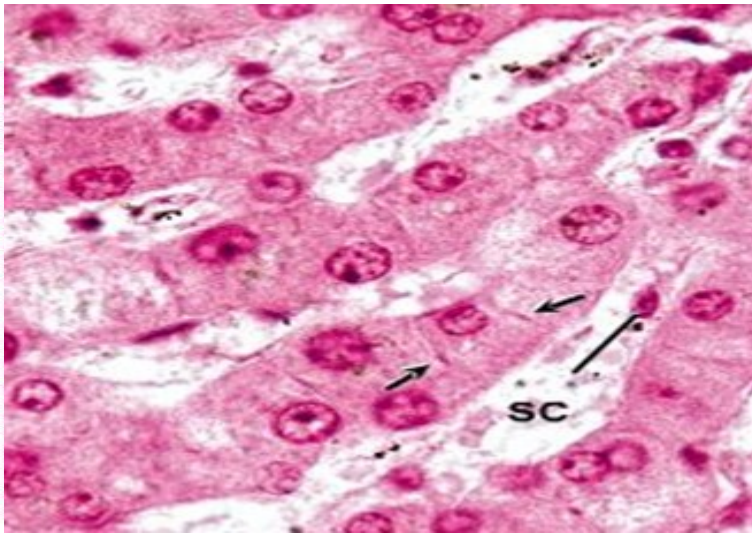


Ross MH, Pawlina W: Histology A Text & Atlas with correlated Cell & Molecular Biology, 6th Edition.

Classic Hepatic Lobule



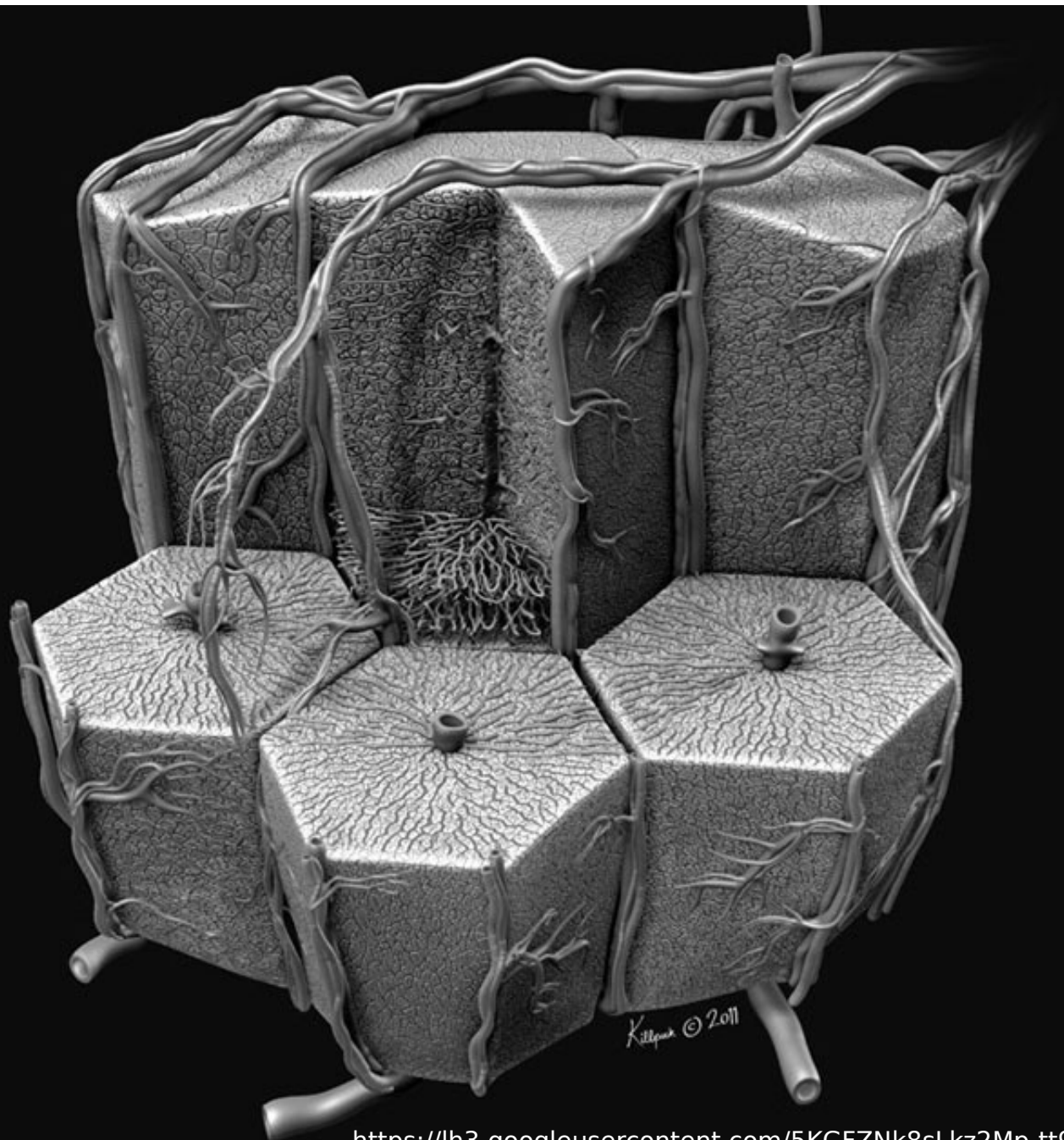
- It is hexagonal in shape.
- The central vein is at the center.
- At the corners: portal areas are found.



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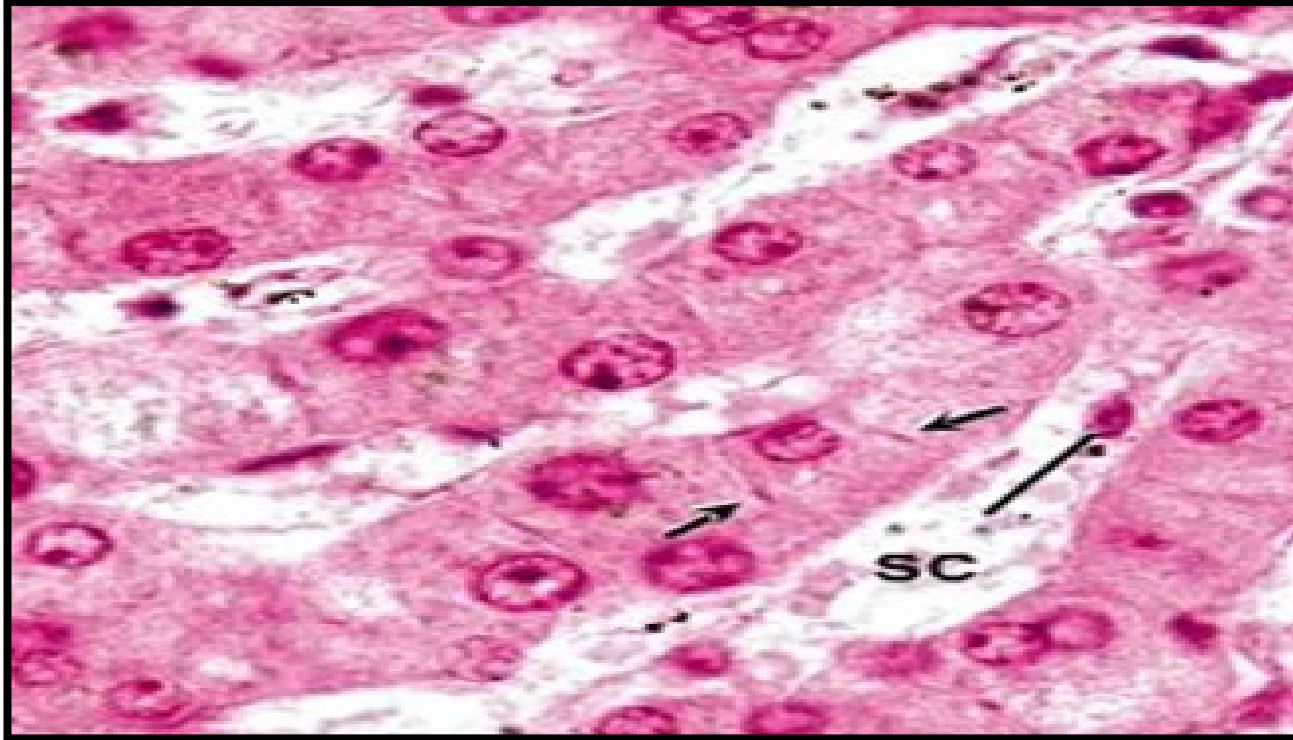
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Hepatic Lobules



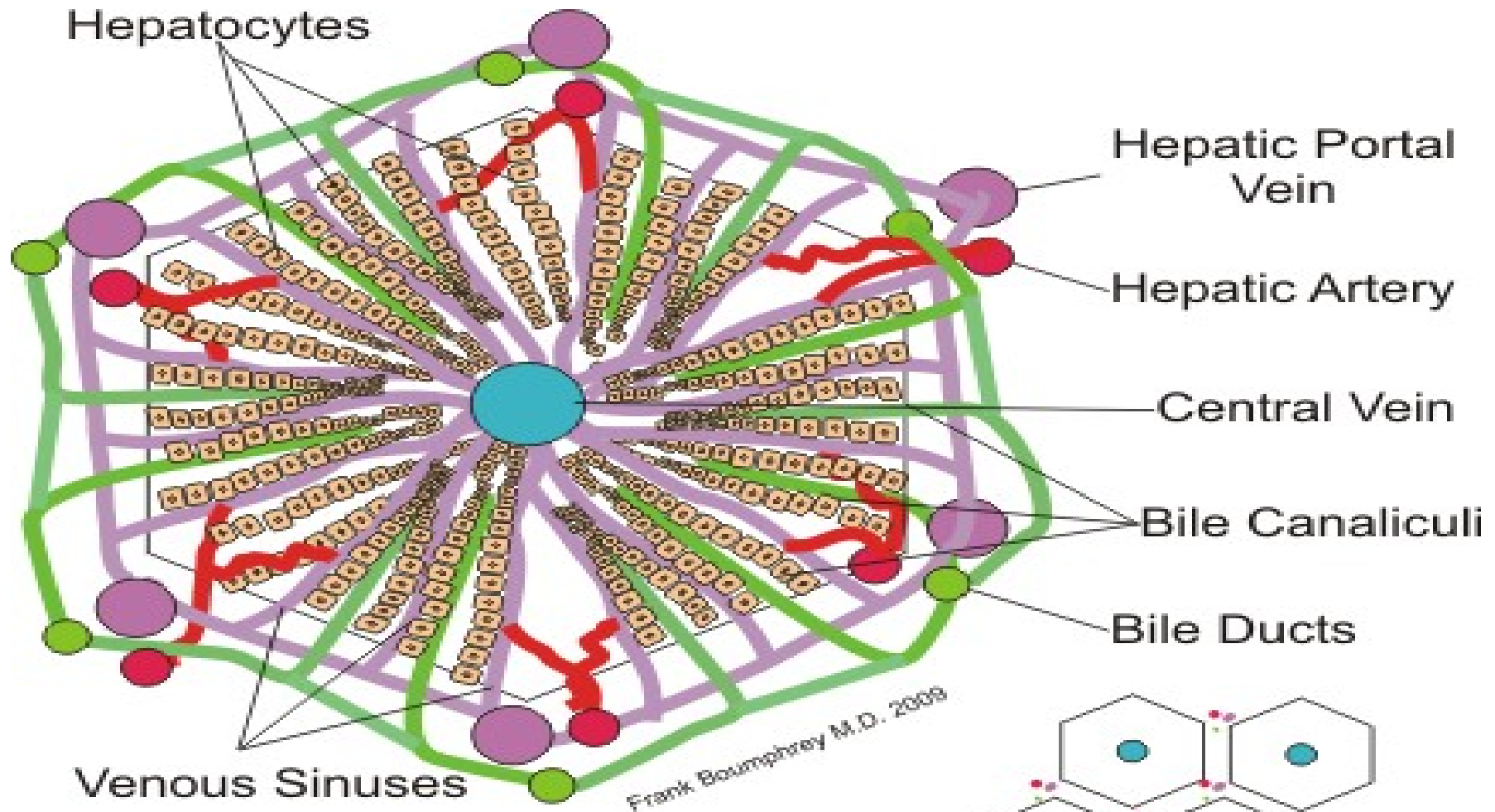
Liver - Hepatocytes

Histology of normal liver tissue

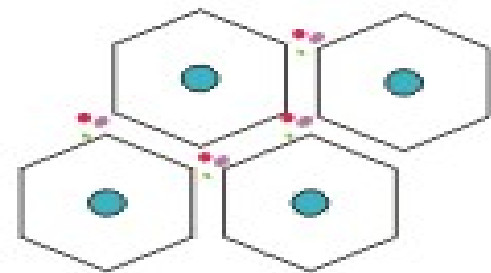


- **Hepatocytes:** branching & anastomosing cords (plates) radiating from the CV to the periphery.
- The cords of hepatocytes: one or 2 cell thick. & separated by sinusoids.

Classic Hepatic Lobule



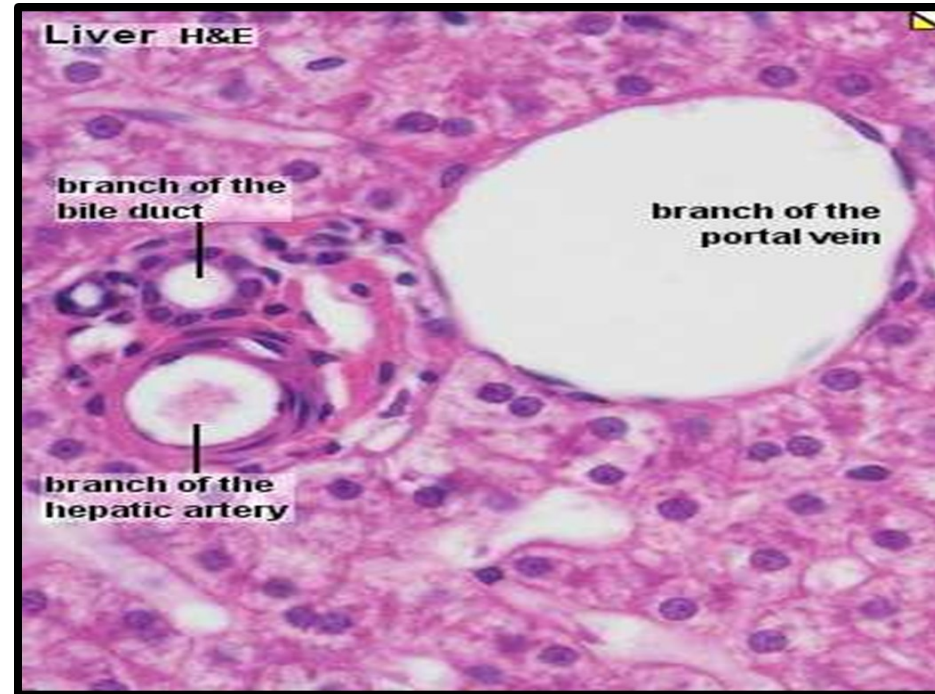
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Portal Tract

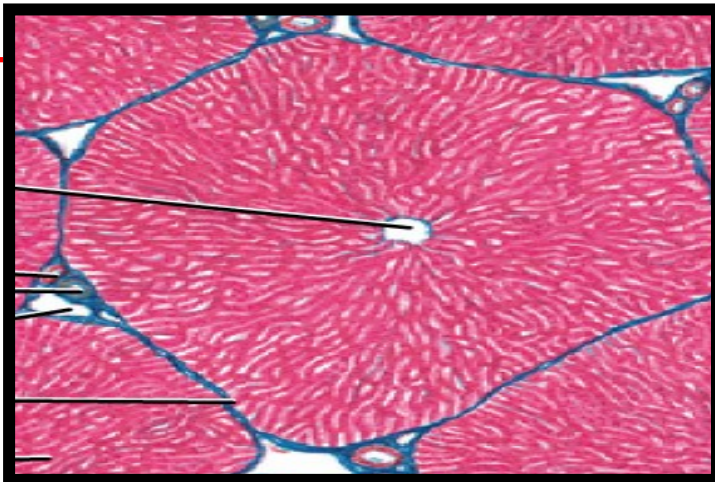


- Found at some of the corners of the classic hepatic lobule.
- It contains:
 1. Branch of the hepatic artery.
 2. Branch of the portal vein (largest).
 3. Branch of the bile duct.

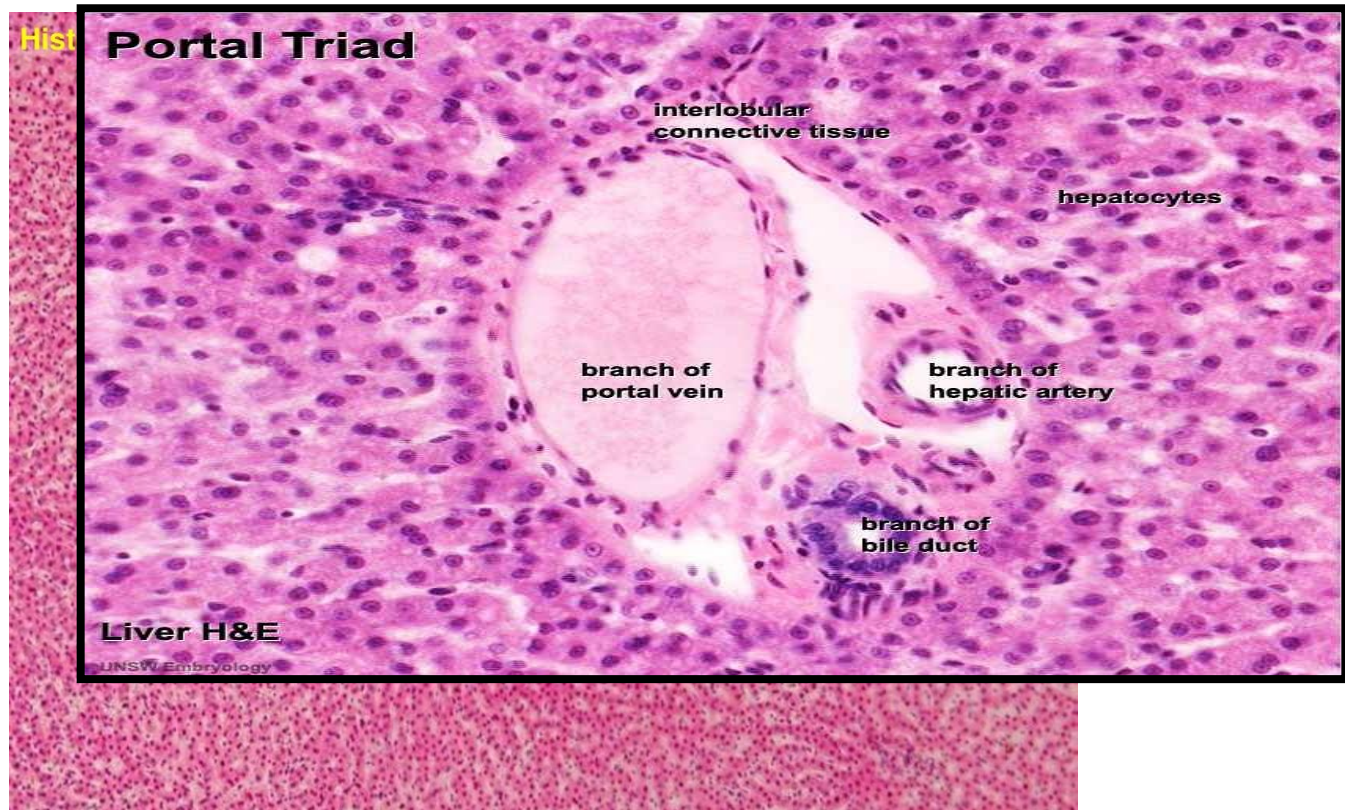


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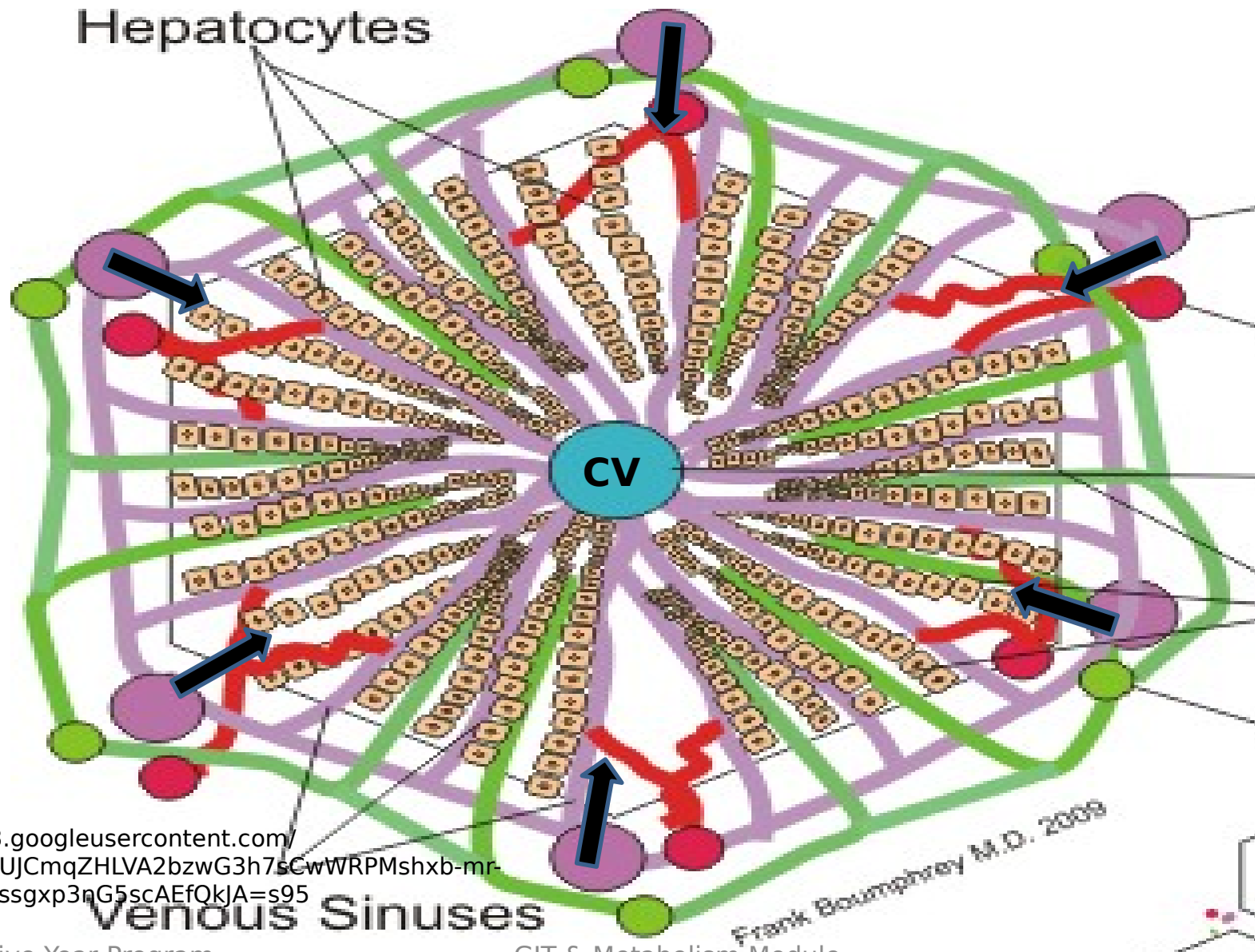
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Liver - Portal Area

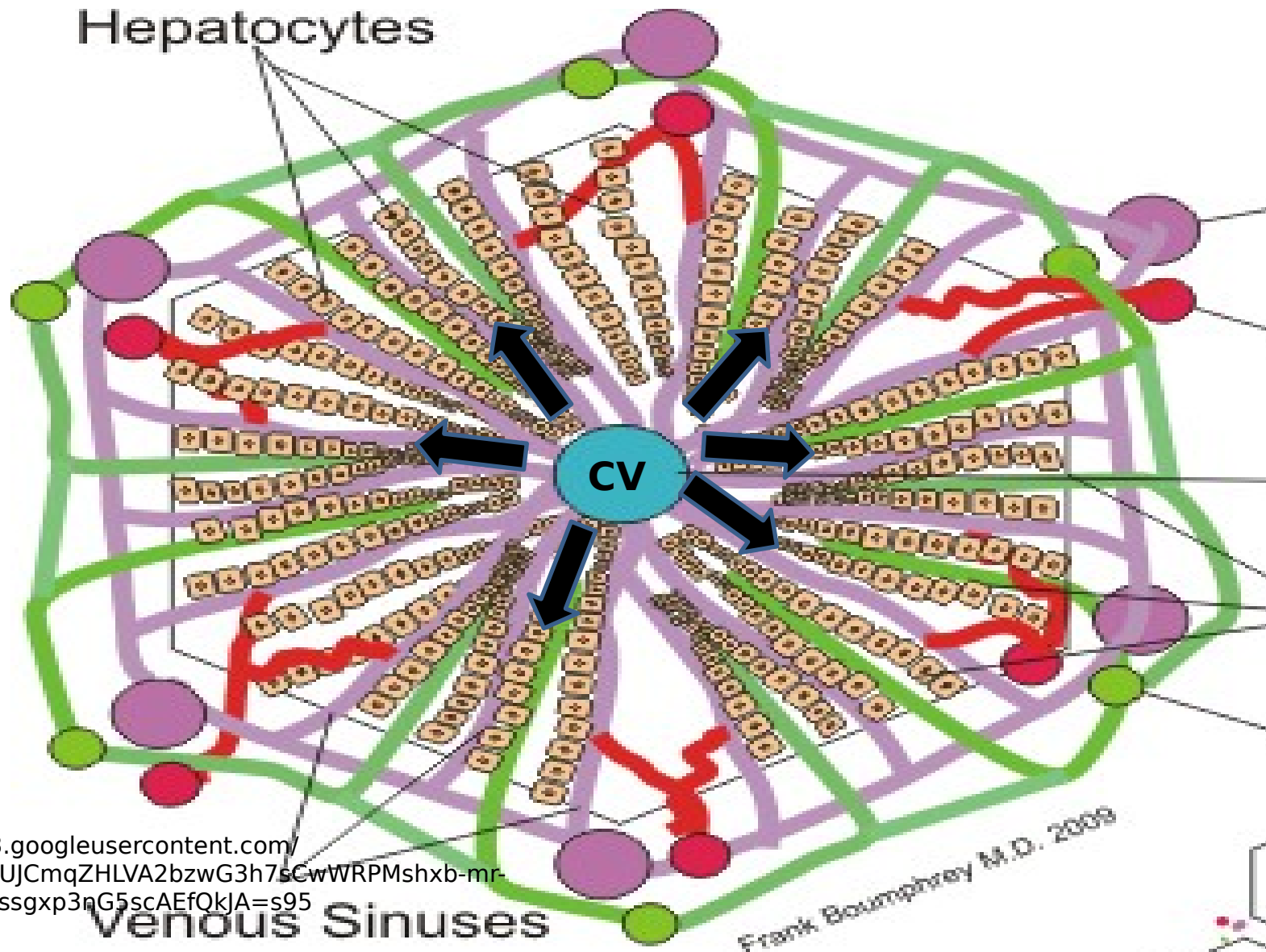


Direction of blood flow



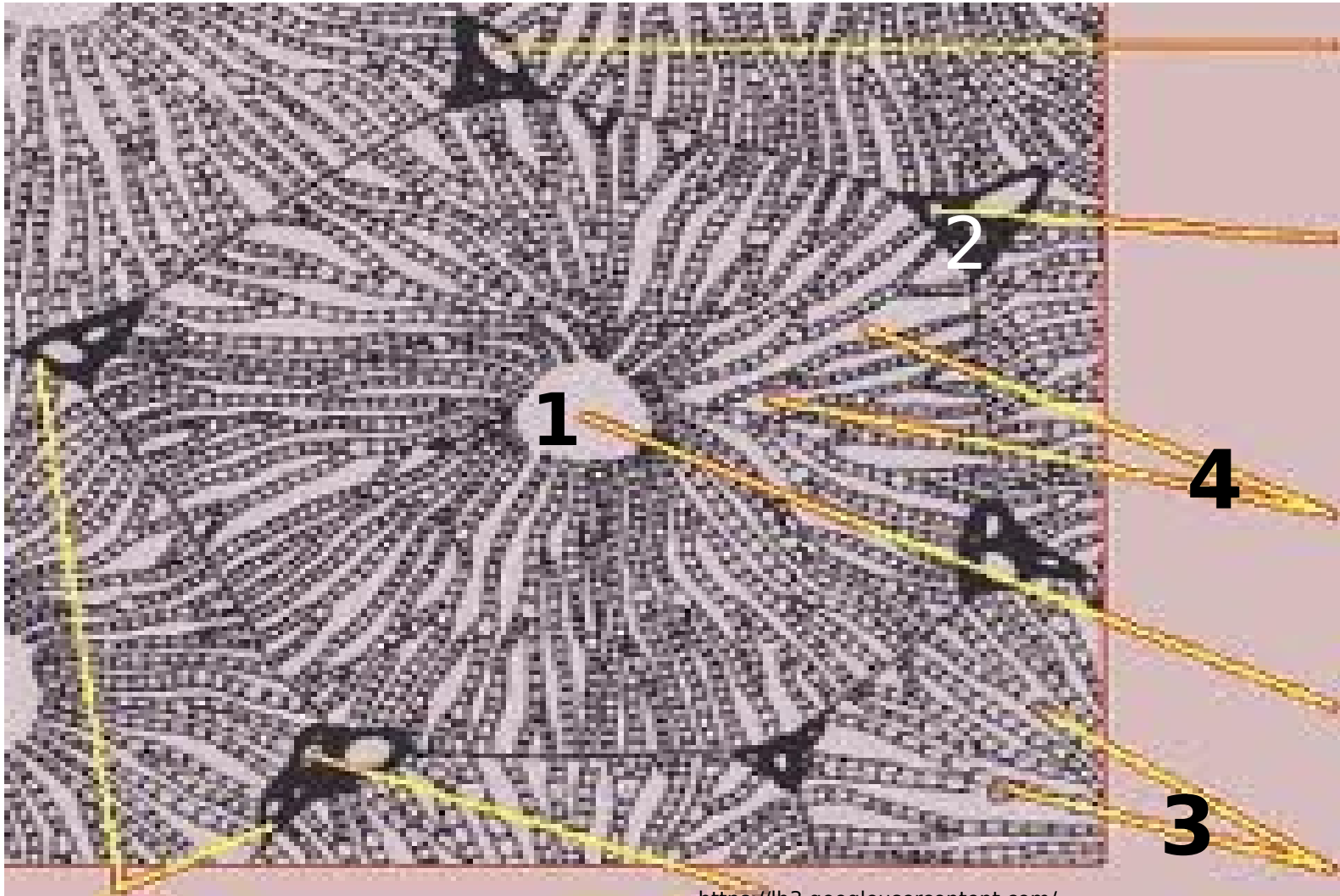
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Direction of bile flow



<https://lh3.googleusercontent.com/vi80a7TrZUJCmqZHLVA2bzwG3h75CwWRPMshxb-mrYgYCijlI27ssgxp3nG5scAEfQkJA=s95>

Classic Hepatic Lobule

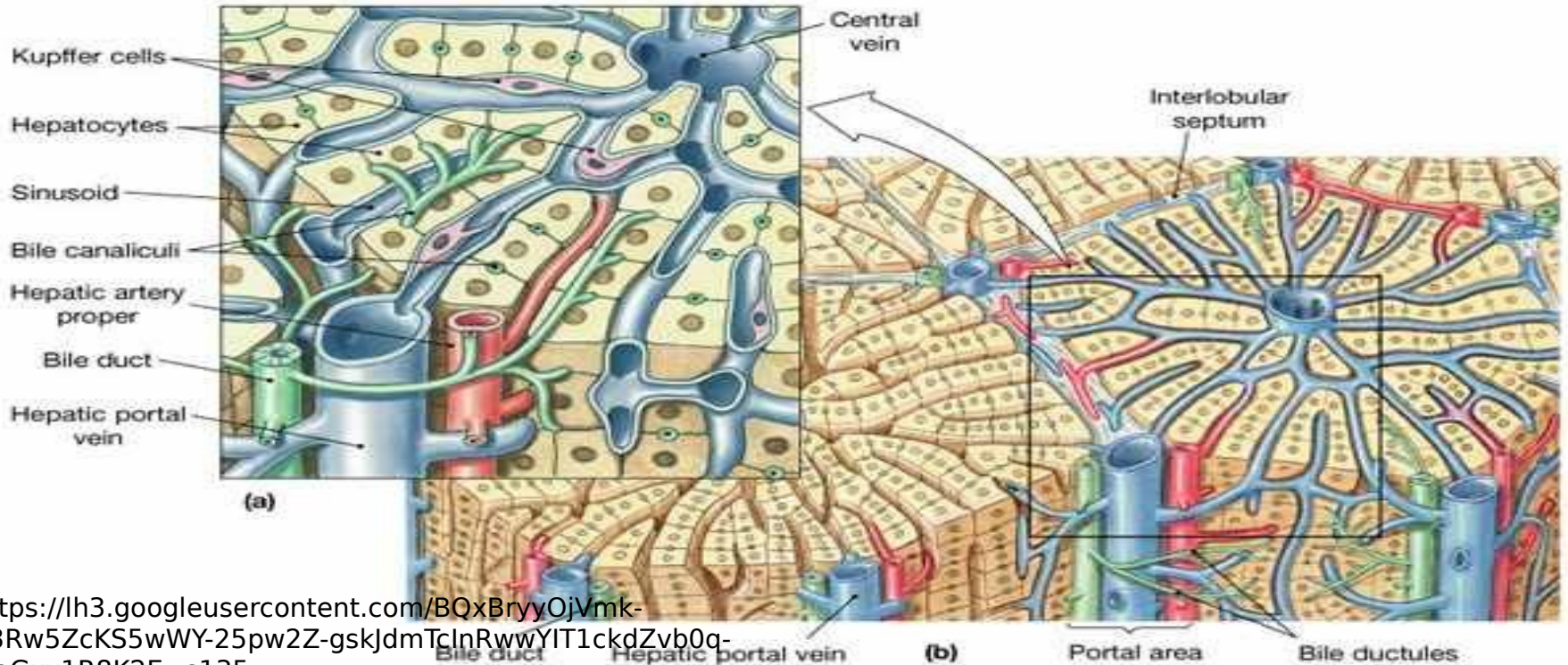


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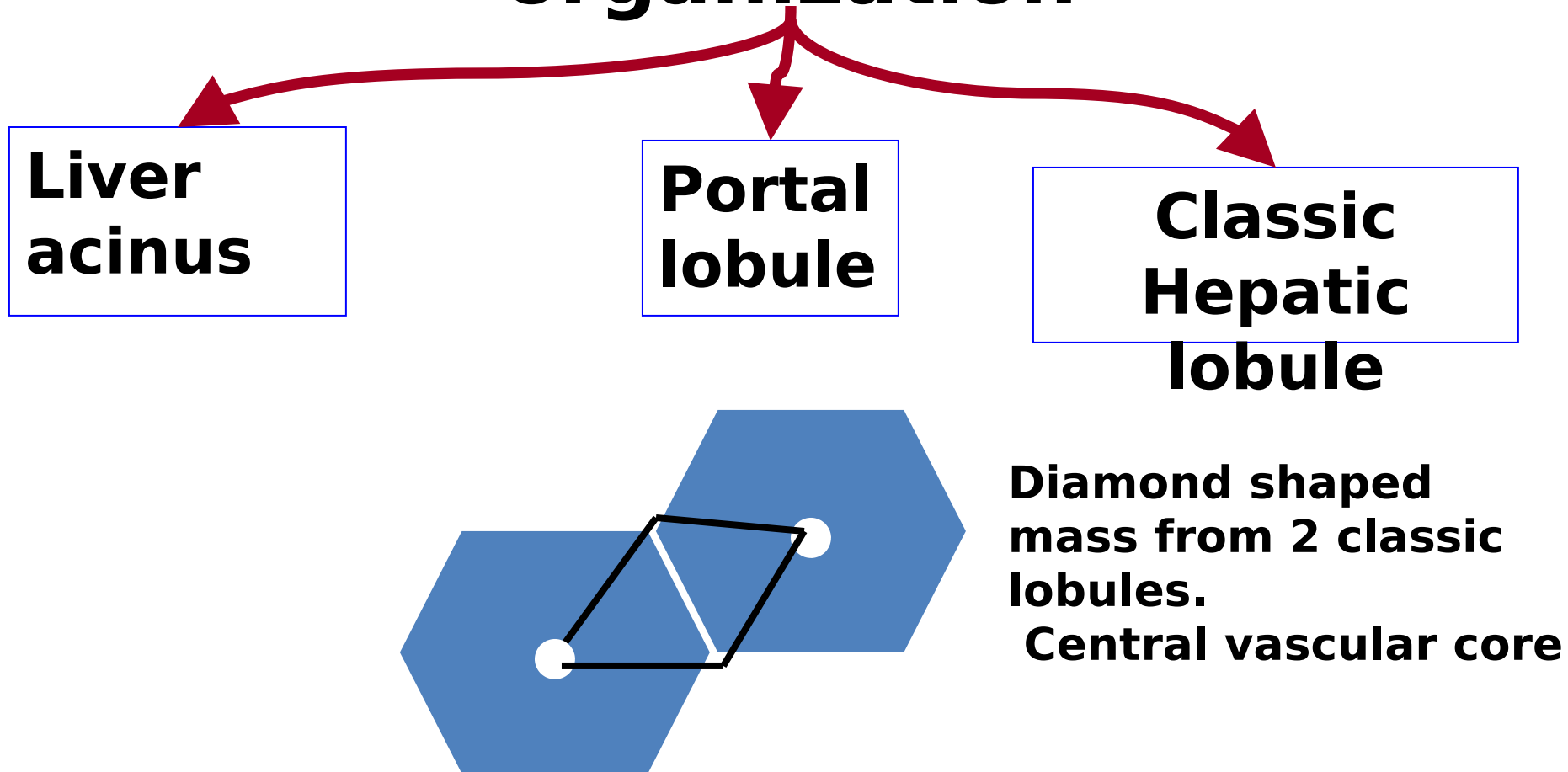
Blood Supply of the Liver



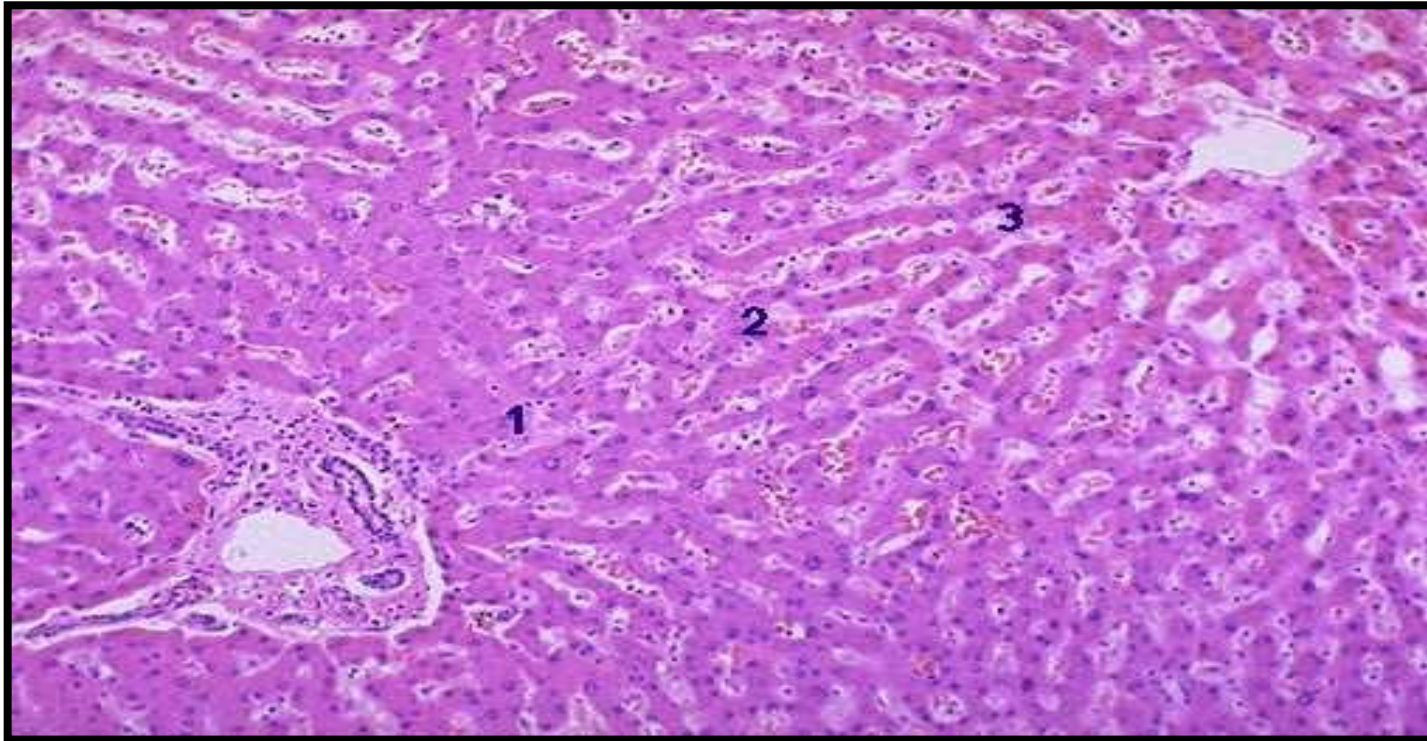
- The liver has two circulatory inputs:
 1. Hepatic artery (25%)
 2. Portal vein (75%)
- Blood from both sources is mixed within the



Classification of hepatocyte organization



The Liver Acinus



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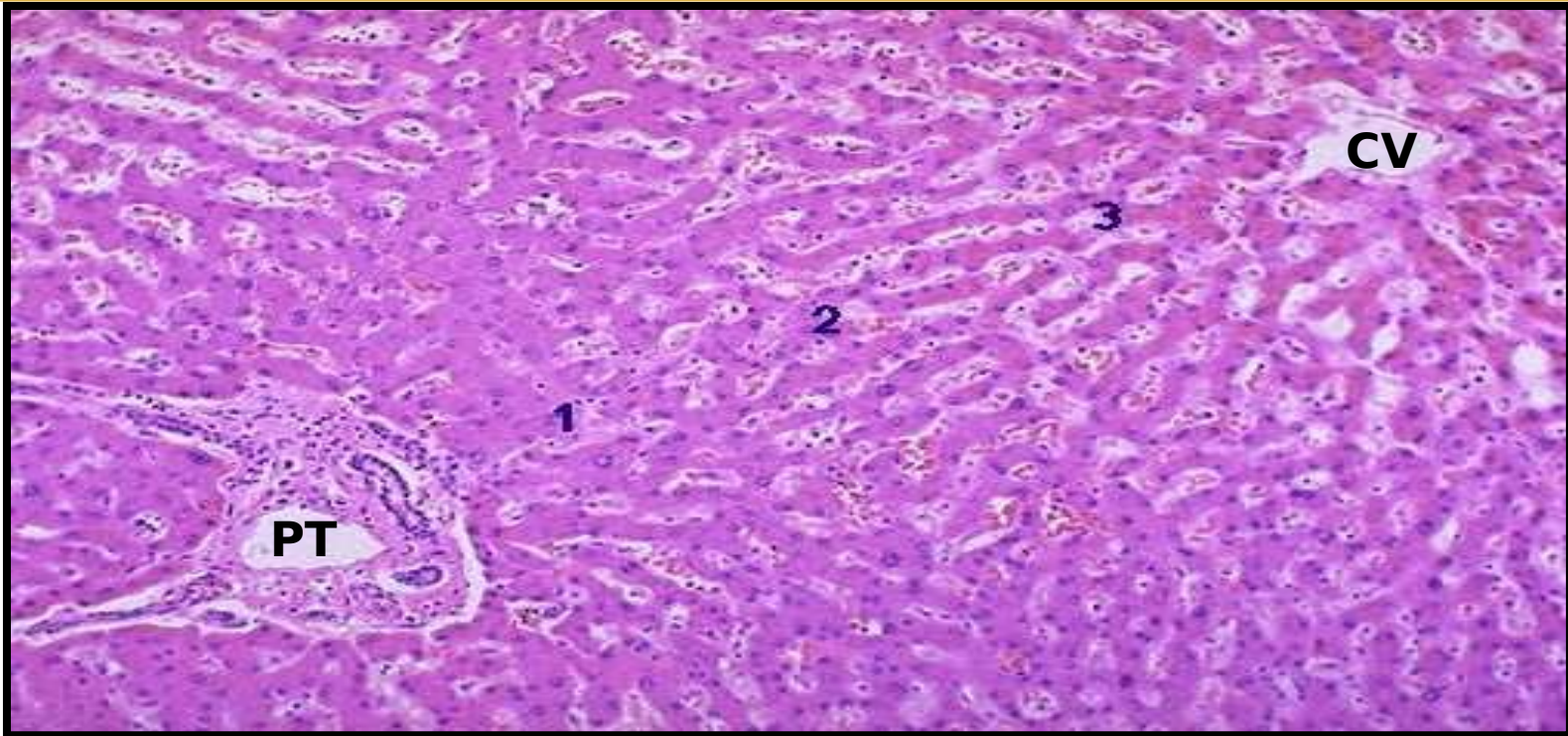
Zone I: close to central vascular core.

Best blood supply.

O₂, nutrients.

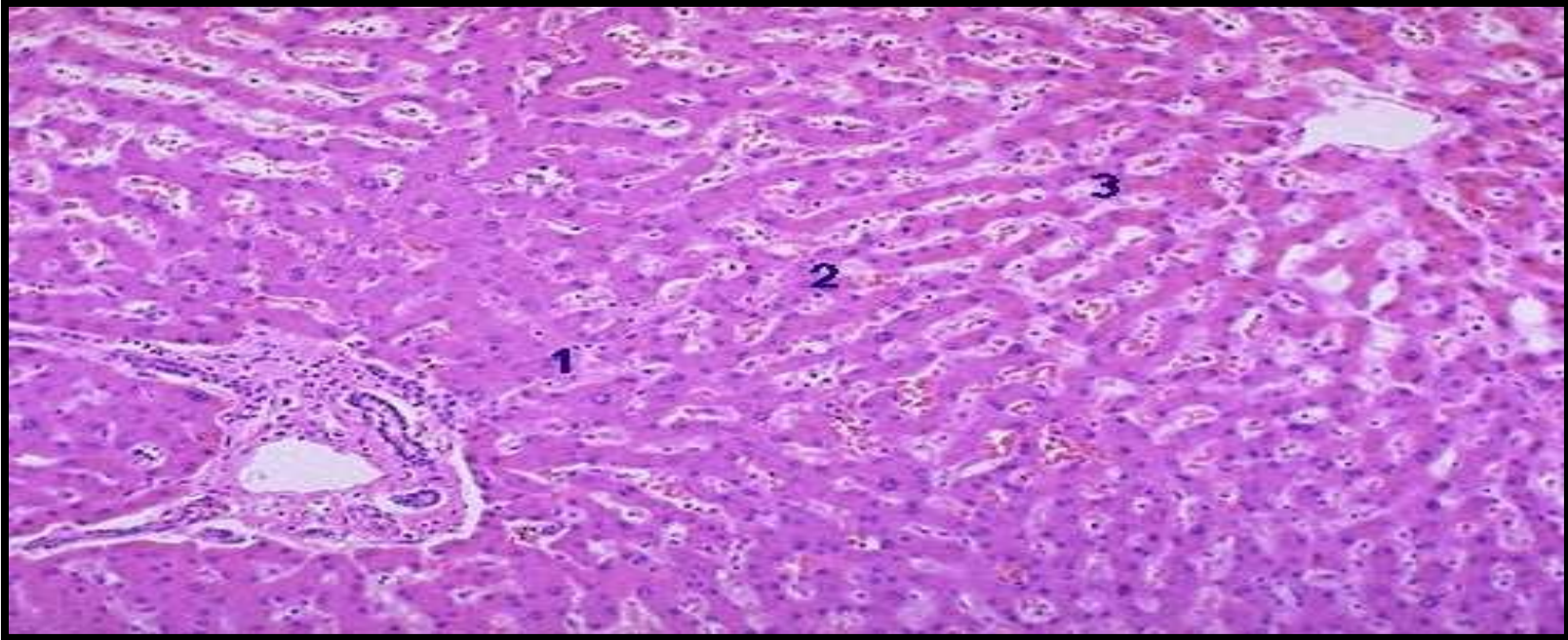
Synthesize glycogen and plasma proteins.

The Liver Acinus



Zone II: surrounding zone I.
Less blood supply than zone I.
Intermediate range of metabolic functions between the two zones.

The Liver Acinus



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Zone III: close to CV, far from vascular core.

Least blood supply, O₂, nutrients.

High sER, (drug detoxification)

high levels of cytochrome P450 (metabolize chemicals, drugs),

Concerned with glycolysis.

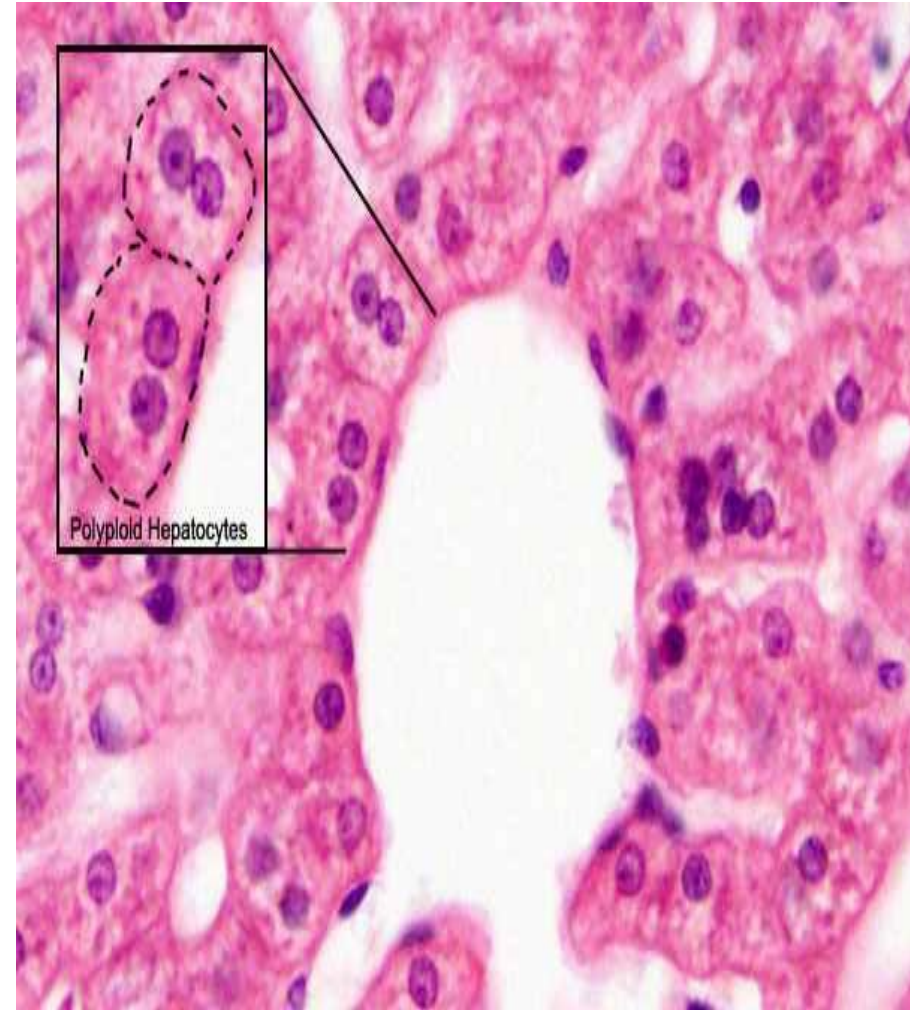
First to undergo ischemic necrosis.

Histological Feature of Hepatocytes



LM

- **Hepatocytes:**
large polygonal cells.
- **Nucleus:** central,
rounded & vesicular.
(25% binucleated)
- **Cytoplasm:**
acidophilic (numerous
mitochondria) + some
basophilic granules
(rER & free
ribosomes).
- **Vacuolations?**



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Histological Features of Hepatocytes



EM

- **Mitochondria:** numerous (1000 per cell) why?
- **RER:** numerous (protein synthesis: albumin, globulin and prothrombin).
- **Golgi:** multiple.
- **SER:** (detoxification, glycogenesis, conjugation of bilirubin.

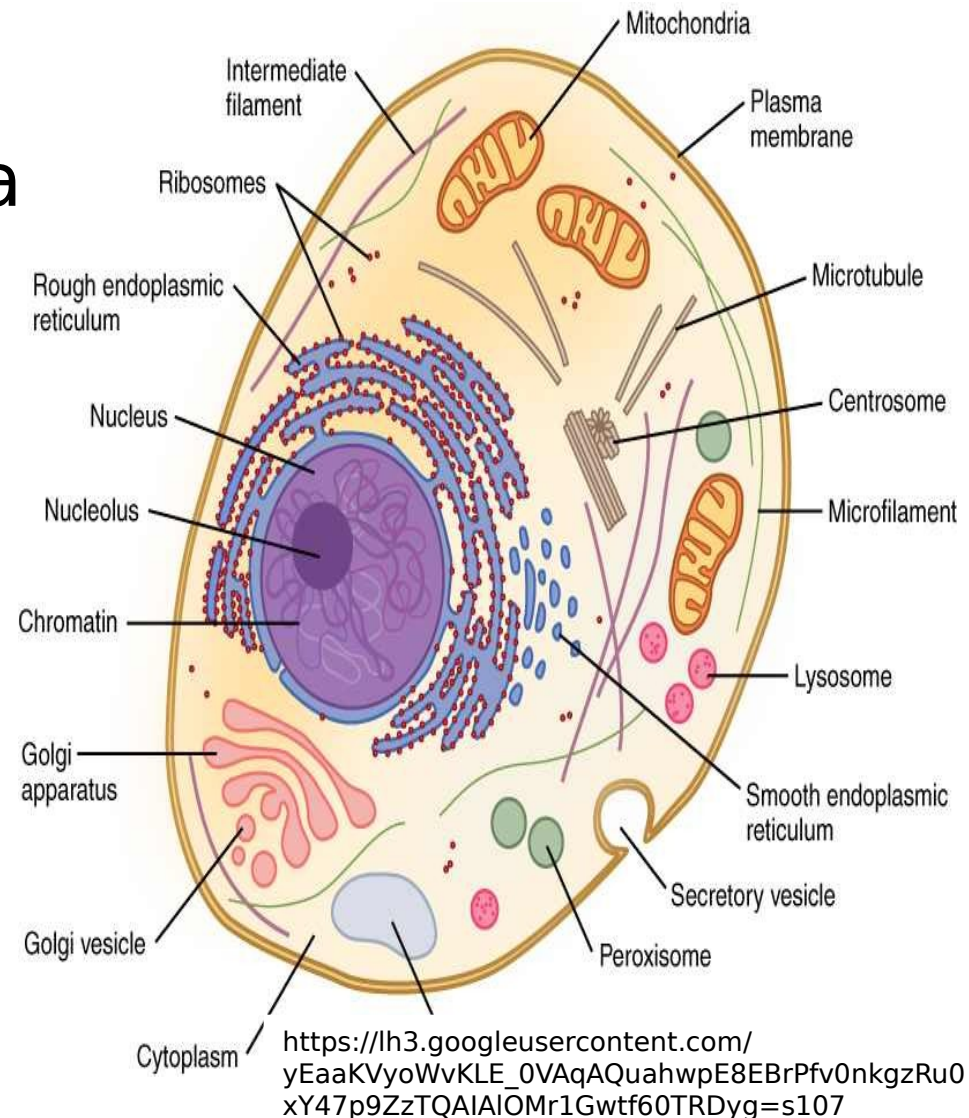


Mescher AL: Junqueira's Basic Histology: Text and Atlas, 14th Edition.
<http://www.accessmedicine.com>

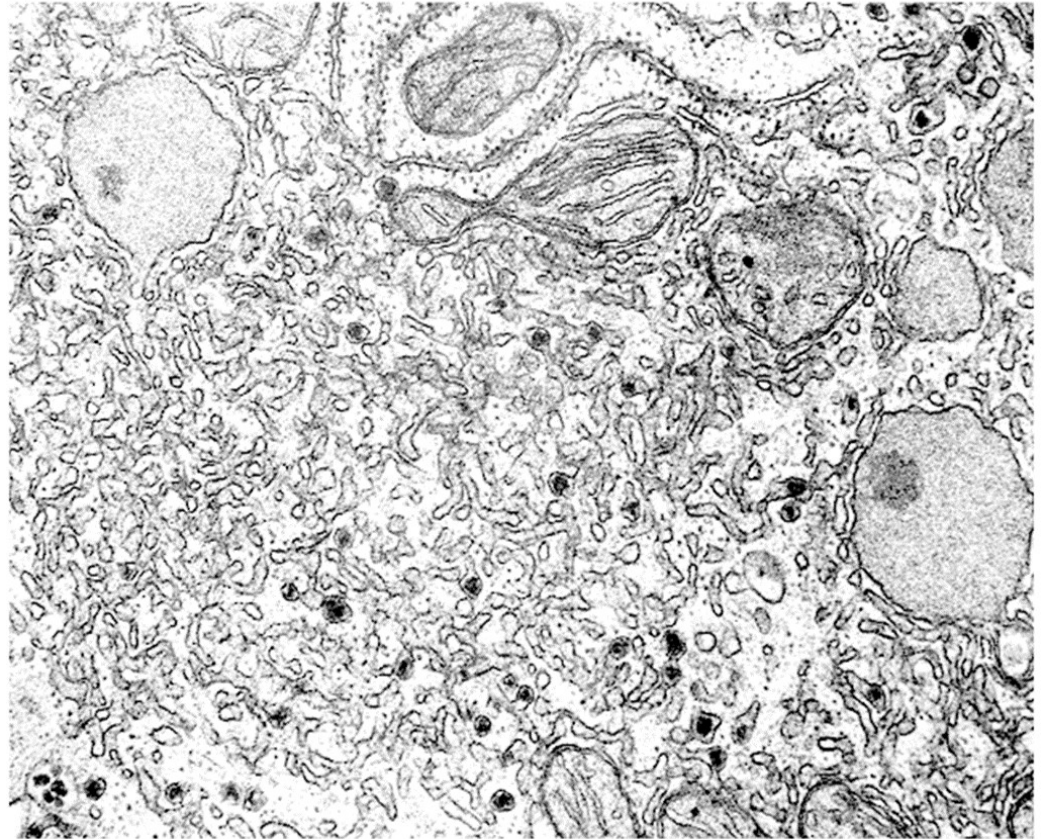
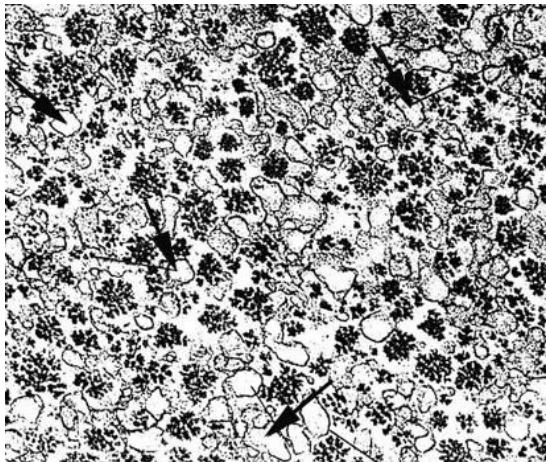
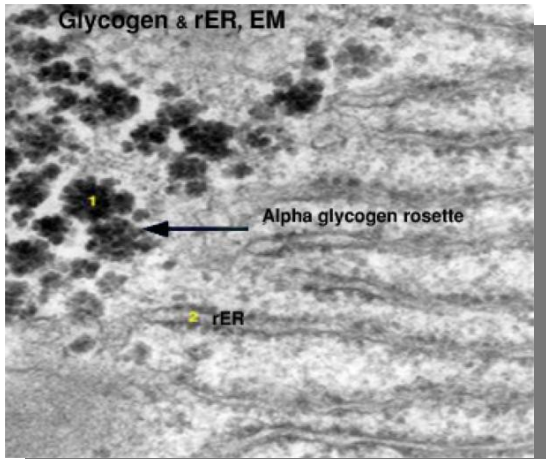
Histological Feature of Hepatocytes



- ❑ **Lysosomes.**
- ❑ **Peroxisomes:** (break down fatty acids by β -oxidation).
- ❑ Actin, Interm. Fs.
- ❑ **Inclusions:**
 - glycogen (rosettes)
 - fat droplets.
 - Lipofuscin pigment.



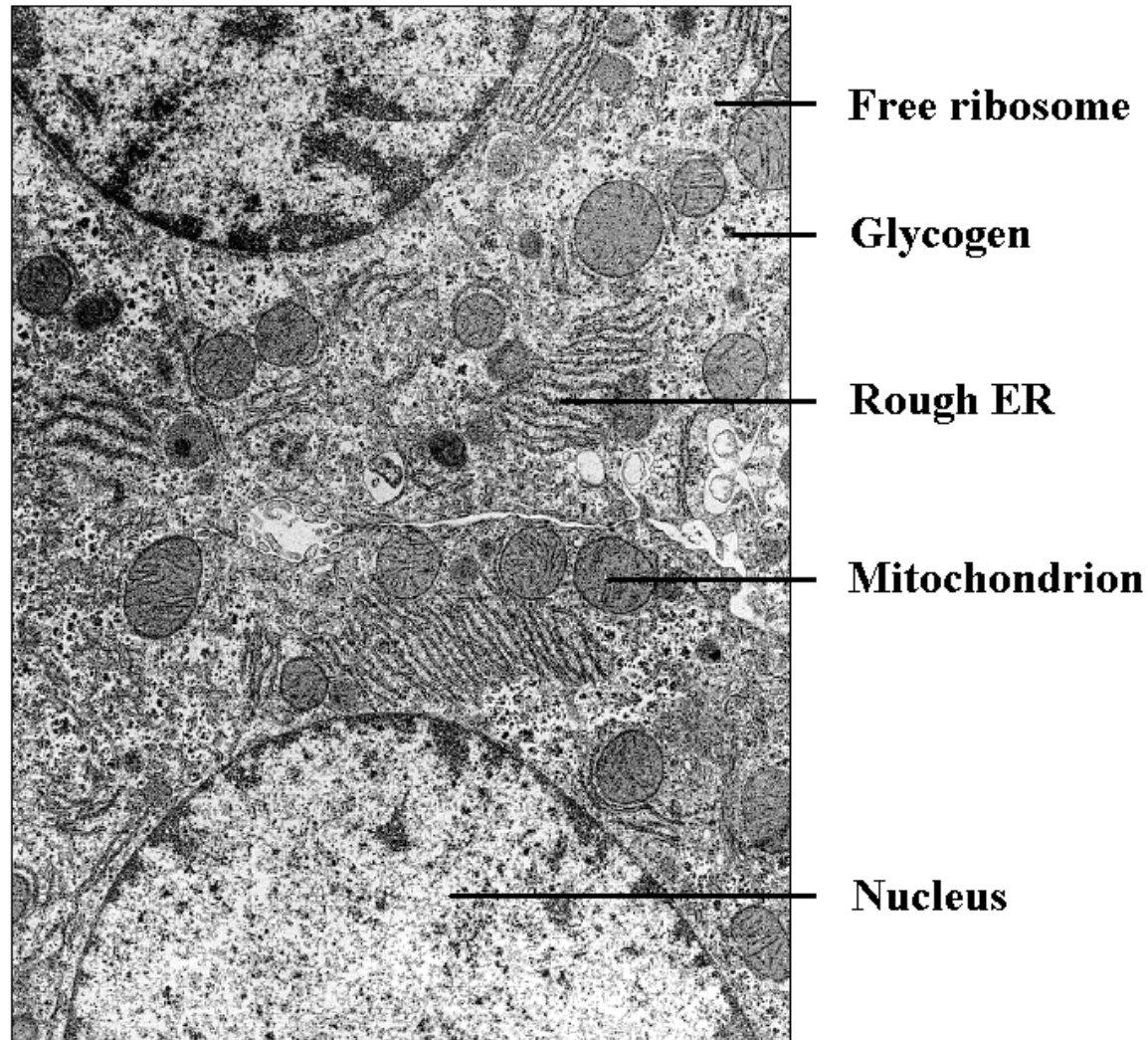
EM of Hepatocytes



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https://lh3.googleusercontent.com/zznCbQG-nMp32vXwHheIRUquXHfqH5GZO-UU4tSn0tFjf362s6FA0pVc_N=s109

Histological Feature of Hepatocytes



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Function of Hepatocytes

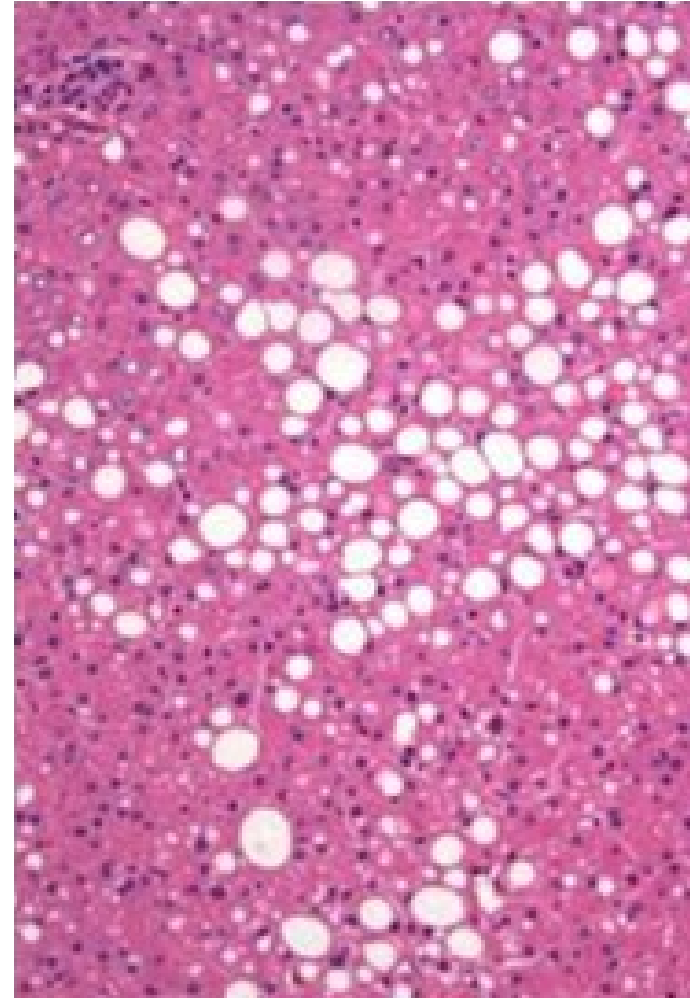


- **Exocrine function:** Bile which help in fat absorption.
- **Endocrine function:**
 1. Secrete glucose
 2. Plasma proteins (albumin, fibrinogen, globulin, and prothrombin) in blood directly. (rER)
 3. Lipoprotein formation (rER, sER).
- **Detoxication** of drugs as barbiturates (sER) and alcohol (peroxisomes)
- **Storage, metabolism of iron.**
- **Metabolic function:**
 1. CHO, Lipid , cholestrol.
 2. Urea formation.
- **Stores and converts many vitamins (A, D, K)**

Medical Application

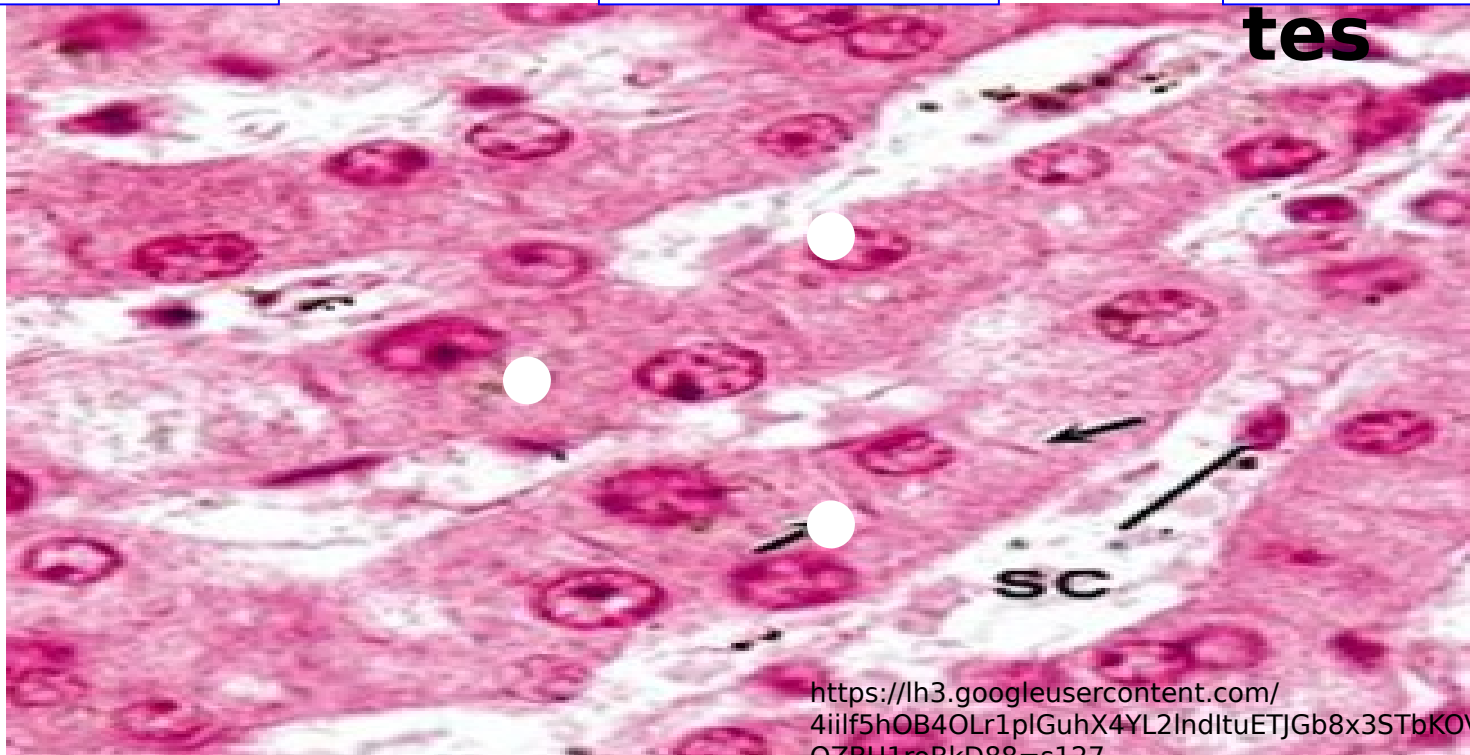
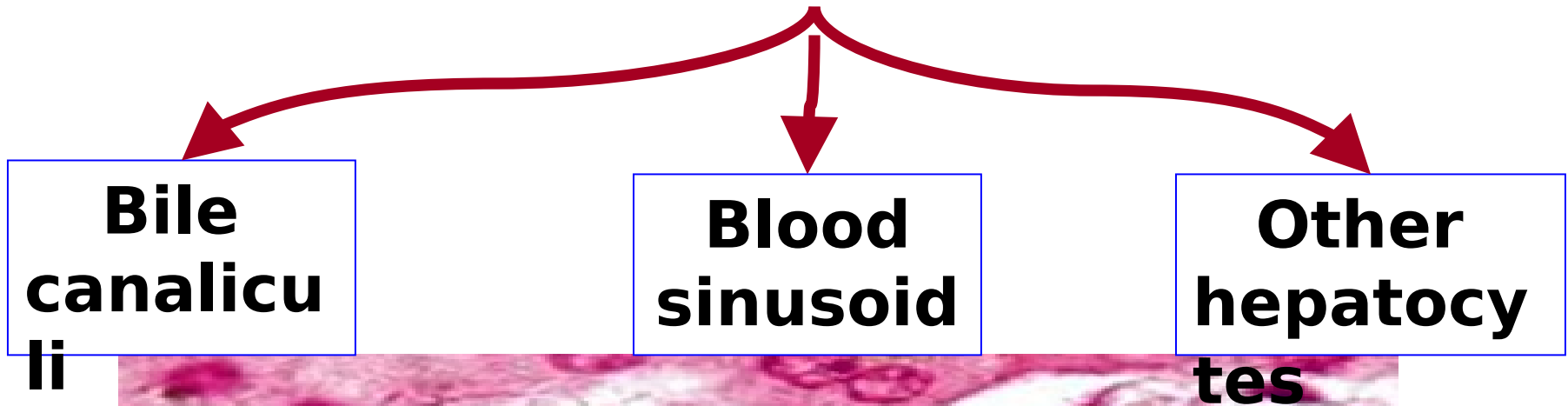


- **Fatty liver disease** is a reversible condition in which large lipid droplets accumulate abnormally in hepatocytes. This disorder has multiple causes, but it occurs most commonly in individuals with **alcoholism** or **obesity**. Accumulation of fat in hepatocytes may produce a progressive inflammation of the liver.



https://bestpractice.bmj.com/image/796/en-us/normal/796-1-highlight_default.jpg

Hepatocytes face either



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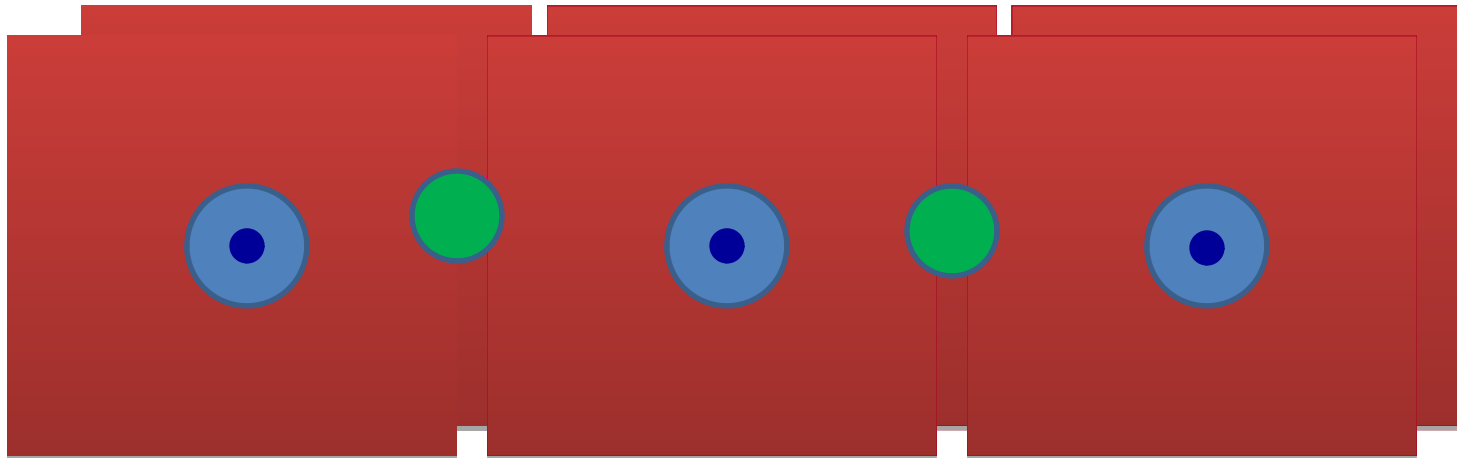
Hepatocytes have three surfaces



**Bile
canaliculi**

**Blood
sinusoid**

**Other
hepatocytes**

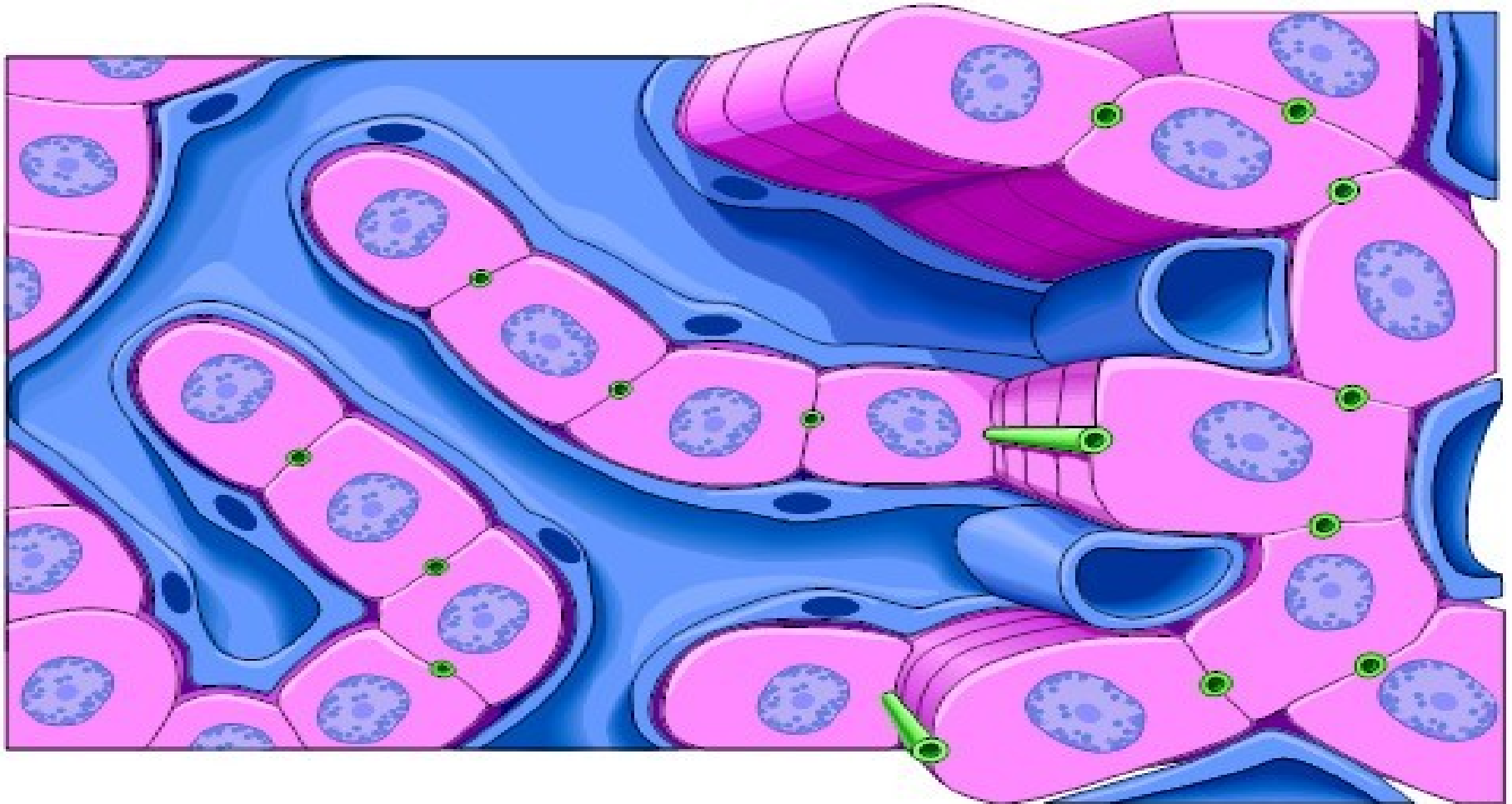


Hepatocytes have three surfaces

Bile canaliculi

Blood sinusoid

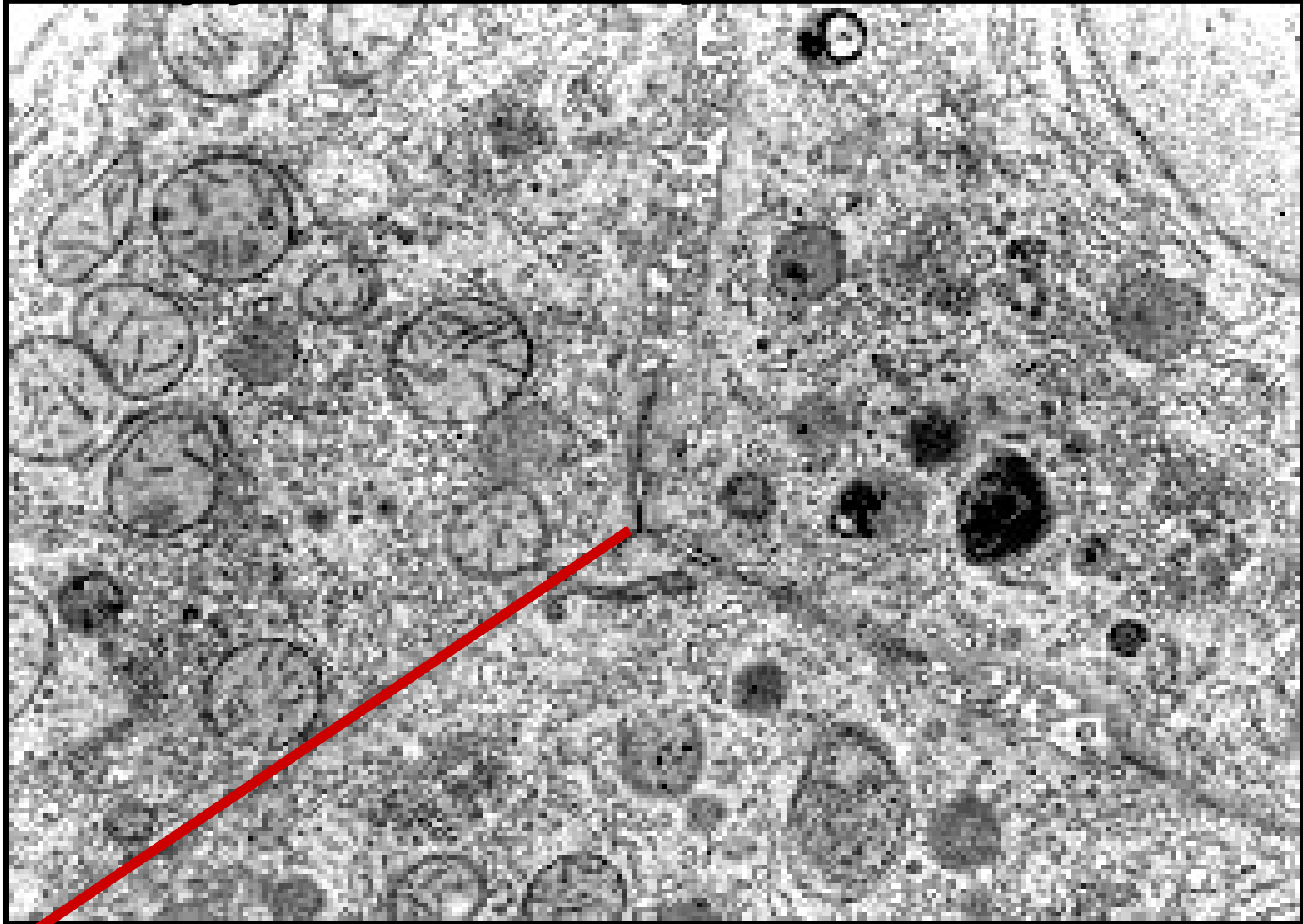
Other hepatocytes



Surface facing other hepatocyte



Joined by junctional complexes



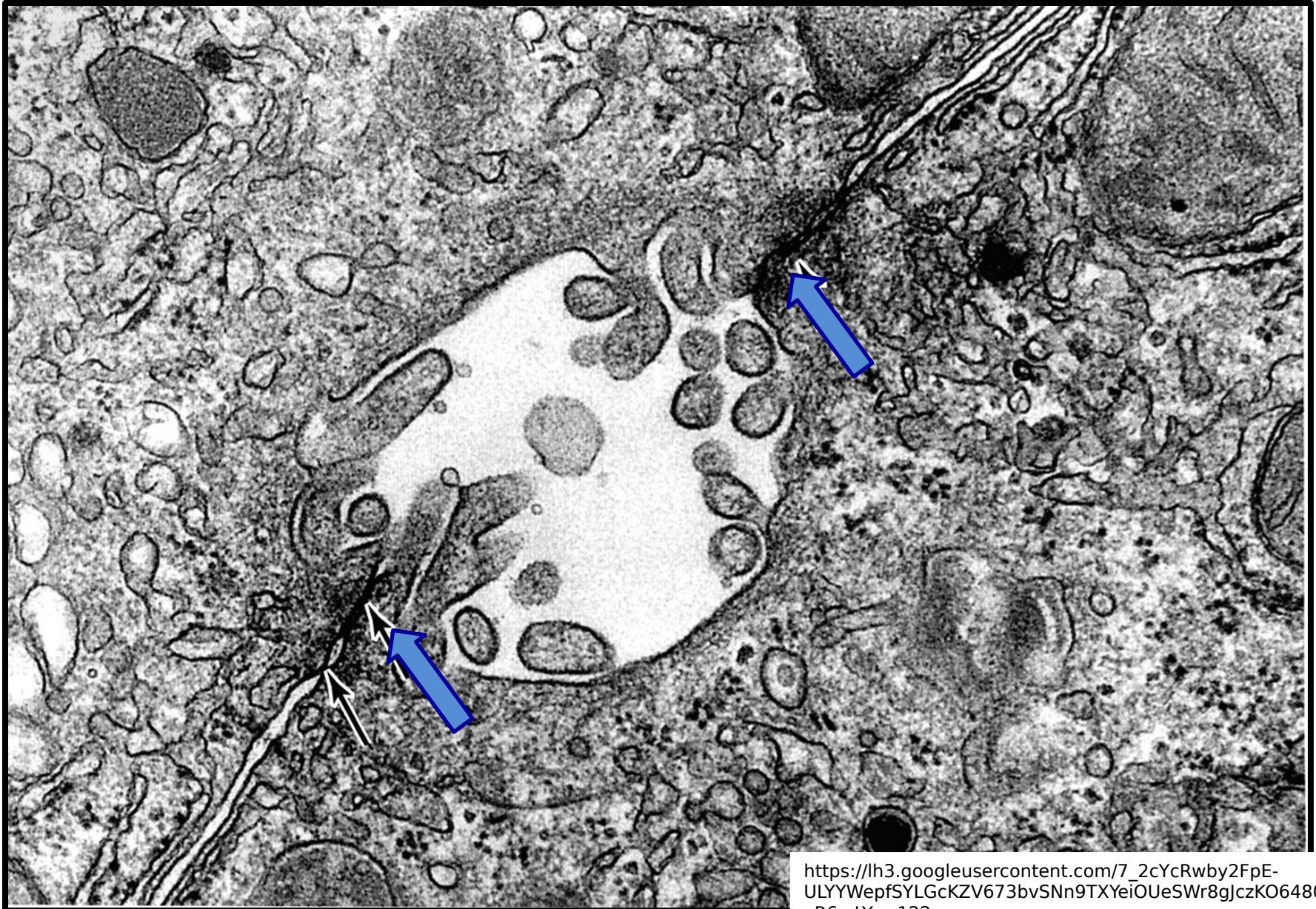
Surface facing bile canaliculus



- Contains short microvilli
- Bile secreted from hepatocytes in the bile canaliculi is the exocrine function of hepatocytes.



Surface facing bile canaliculus

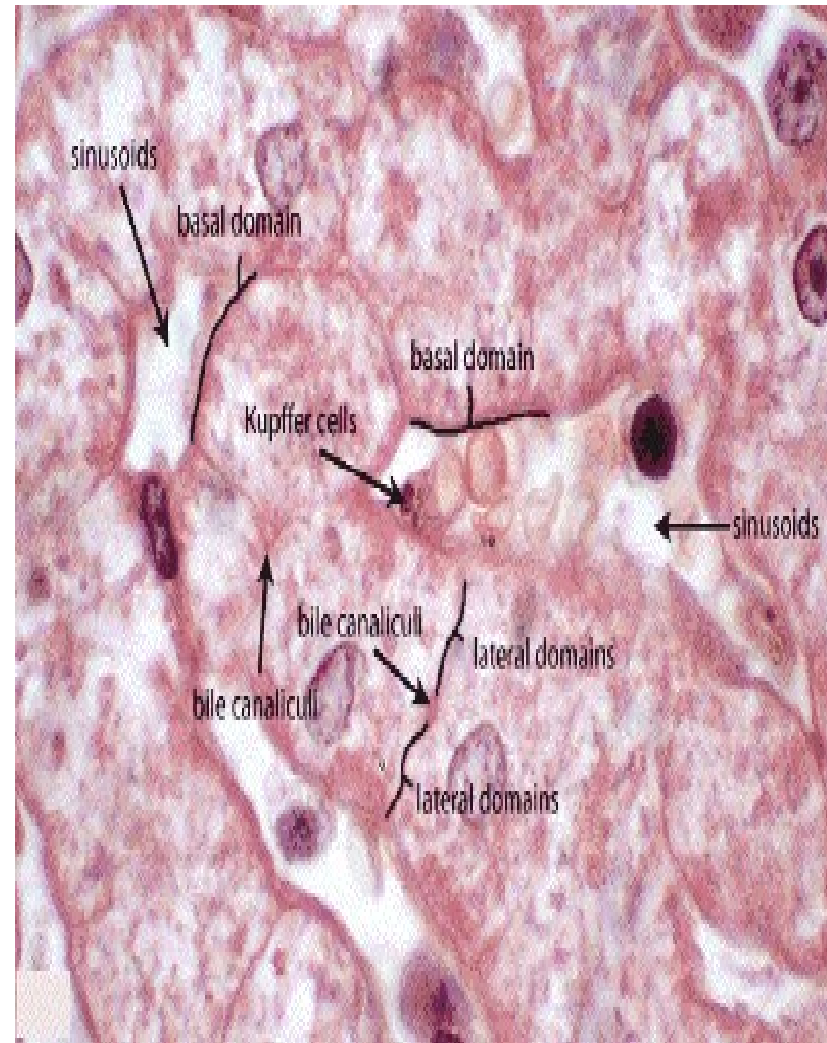
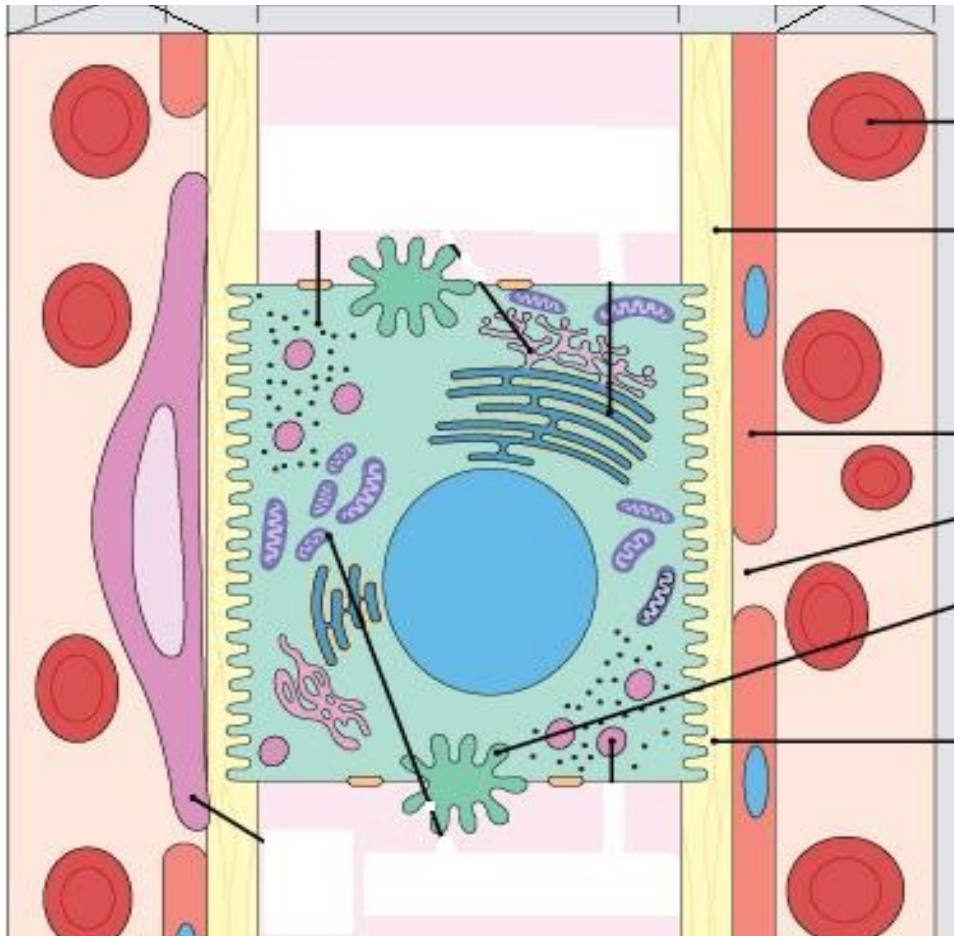


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Surface facing blood sinusoid



- o Contains many long microvilli .
- o Why?



Summary



Classification of the liver: classic hepatic lobule, portal lobule, liver acinus

The classic hepatic lobule is hexagonal in shape with a central vein and peripheral portal tracts.

The portal lobule is triangular and related to a central bile duct.

The liver acinus is diamond in shape and has a central vascular core

Hepatocytes are acidophilic and 25% are binucleated. By EM, all organelles are abundant.

Hepatocytes have three surfaces facing either bile canaliculi, another hepatocyte and blood sinusoid.

Question



- Hepatocytes in zone 1 are characterized by which of the following?
 - a. They lie close to the central vein
 - ☒ b. They are active in drug metabolism.
 - c. They have the best blood supply.
 - d. They have the least glucose supply.

Question



Which of the following best explains the presence of vacuolation detected in hepatocytes by LM?

- a) Numerous mitochondria.
- ☒ b) Abundant peroxisomes.
- c) Fat & glycogen granules.
- d) Well-developed RER.
- e) Heterolysosome.

Suggested textbooks



- 1- Junqueira`s Basic Histology; Text and Atlas. 14th edition 2016, pp: 329-332.
- 2- Histology atlas and test: Michael H. Ross and Wojciech Pawlina, 7th edition, 2015, pp: 545-553

Thank You

